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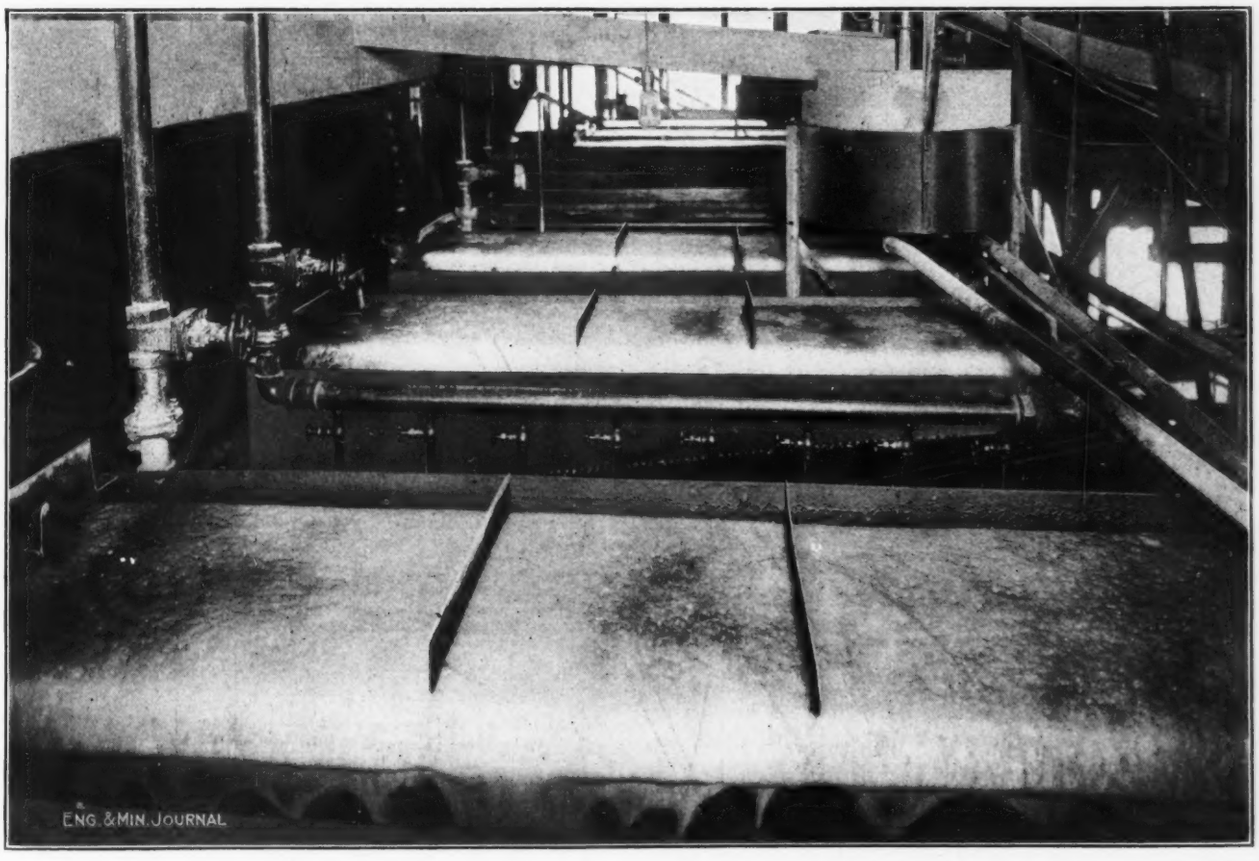
Mill of National Copper Mining Co.

By Ernest Gayford*

SYNOPSIS—A copper concentrator in the Coeur d'Alene district using a new flotation process. Dry crushing to ½ in. is followed by wet gravity and flotation concentration; recovery 85%. Callow pneumatic flotation cells are used; oil consumption about ¼ lb. per ton treated.

The mill of the National Copper Mining Co., which went into commission early in April, is of particular interest to the mining public from the fact that it emphasizes the possibilities of the Cœur d'Alene district as a copper producer, and also because it is the first mill to use the Callow pneumatic flotation process.

The ore treated is described by Fred T. Green, the company's consulting engineer, as "a comparatively clean, hard, white-to-gray quartzite, in which various sulphide minerals are more or less uniformly disseminated. These sulphide minerals are chalcopyrite, chalcocite, bornite and pyrite; the proportions of the minerals being chalcopyrite, 3.48%, chalcocite and bornite, 0.50; pyrite, 3.51; silica, 91.10; lime, 1.60%." The ore is extremely hard, close grained and crushes in wedge-shaped pieces, causing much wear on the coarse-crushing machinery, screens, etc. The flow sheet of the mill was determined from tests made by the General Engineering Co., of Salt Lake City; the mill being designed and erected under the direction of J. M. Callow, with Karl Bernson in personal charge of construction work. Construction was started about the middle of August, 1913, and continued, with



Callow Pneumatic Flotation Cells in National Mill, Mullan, Idaho

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about 15 days intermission at Christmas, until the mill went into commission early in April of this year.

The mill site has a slope of 30° to the south, thus making an ideal hillside location, the elevation from the track to the top of the ore bin being 201 ft. Although somewhat costly for erection and retaining walls, the hillside permitted a gravity flow of ore in the mill, with the exception of one main elevator for elevating crushed ore to the storage bins ahead of the first line of Hardinge mills, and three small elevators for returning oversize back to the mills, and table middlings for retreatment.

Dry Crushing, Followed by Gravity and Flotation Concentration

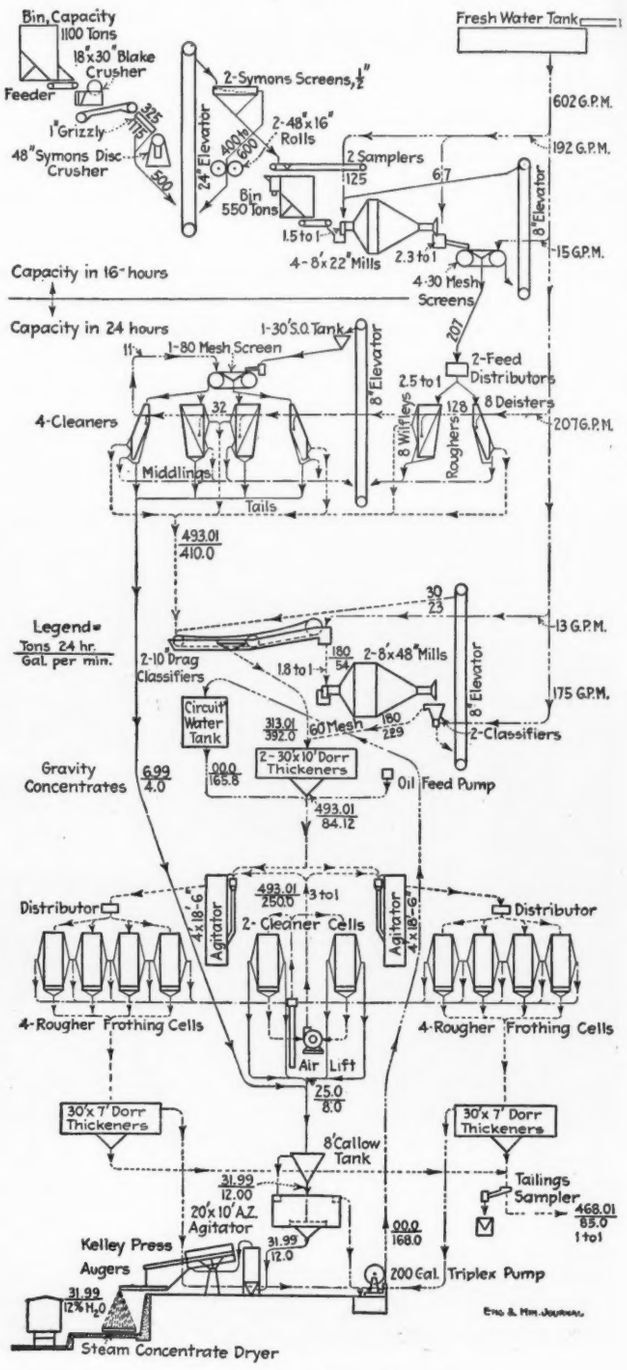
The dry crushing plant, which crushes the run-of-mine ore to ½ in., has a capacity of 500 tons in 16 hr., and the concentrating plant 500 tons in 24 hr. The floor space for each department is as follows: Dry-crushing depart- 68x42 ft.; first Hardinge mill floor, 98x27; table floor, 98x48; second Hardinge mill floor, 70x13; first Dorr tank floor, 70x36; flotation floor, 70x27; second Dorr tank floor, 70x36; concentrate floor, 68x28 feet.

The flow sheet appended is extremely simple; it was not found necessary to make any changes from that determined in the tests, except that the eight Wilfley and eight Deister tables treating the undersize from the 30-mesh Callow screens make no finished products, it being found better to make a dirty concentrate on the tables and clean it up on two Wilfleys and two Deisters, rather than make a finished concentrate on the original treatment tables and clean up middlings only.

The main storage bins have a capacity of 1100 tons of run-of-mine ore, which is delivered to them by an electric road from the mine, about two miles distant, the road having a maximum grade from mine to mill of 4½%. From the storage bin, the ore is fed by a traveling-belt feeder to the main crusher, quartzite for the tube-mill pebbles being picked off the feeder and delivered by an 8-in. belt conveyor to pebble storage bins ahead of the Hardinge mills. The product of the coarse crusher (maximum size, 5 in.) is delivered by belt conveyors on a 1-in. grizzly, the oversize of which goes to a 48-in. Symons disk crusher, is reduced to 1 in., elevated to two 48x84-in. Symons pulsator screens, the oversize going to two 16x48-in. rolls working in close circuit with the screens, the undersize from the screens being distributed into 550-ton storage bins.

Ore Crushed to ½ In. Dry

It was the original intention to reduce the ore in the rolls to ¼ in., but it was found that, owing to the physical nature of the ore, this threw too heavy a burden on the rolls and screens, and also that the 8-ft. by 22-in. Hardinge mill handled a ½-in. feed equally as well as ¼-in. From the storage bins the ½-in. product goes to four Hardinge pebble mills, each mill being fed by independent traveling-belt feeders and working in closed circuit with a 30-mesh Callow traveling-belt screen. The mills are driven by rope drives from one countershaft, and each is equipped with a friction clutch. As the feed to the Hardinge mills is dry, the consistency is easily controlled by the addition of the correct amount of water as the dry ore enters the feed box. The undersize from the 30-mesh Callow screens is automatically distributed over eight Wilfley and eight Deister tables, the rough concentrates from these tables being sized to 80-mesh, the oversize and the undersize being cleaned separately on two Wilfleys and two Deisters. All table tailings fall by gravity to two drag classifiers, the overflow from which goes direct to the upper Dorr thickeners; the sands go to two 8-ft. by 48-in. Hardinge pebble mills, working in closed circuit with two single-spigot classifiers, the spigot



Flow Sheet of National Mill

product from which is returned by an elevator to the mills, the overflow going with the drag-classifier overflow to the upper Dorrs. These Hardinge mills are set to crush to 60-mesh (0.011 in.); the screen analysis of the discharge, using Tyler's standard screen scale, was as follows: Passing 35-mesh but retained on 48-mesh, 1.4%;

retained on 65-mesh, 5; retained on 100-mesh, 12.4; retained on 150-mesh, 21; retained on 200-mesh, 19; passing 200-mesh, 41.2 per cent.

Flotation by Callow Pneumatic Process

The minus-60-mesh material is delivered in two equal streams to two 30x10-ft. Dorr thickeners of especial heavy design equipped with automatic overload alarms; the pulp is thickened to approximately 1½ : 1, diluted with flotation circuit water to 4½ : 1, each Dorr tank making feed for one unit of the Callow pneumatic flotation process. Each flotation unit consists of one mixing tank, four roughing and one cleaning cell, and has a capacity of 250 tons in 24 hr. The mixing tanks are of the Pachuca type, mixing being accomplished by air at 20-lb. pressure, furnished by an Ingersoll-Rand 60-cu.ft. compressor; the function of these tanks being thoroughly to mix the oil and pulp previous to sending the pulp to the separating cell. Each mixing tank is equipped with an adjustable splitter cutting out the proportion of the agitated pulp as desired; the oiled pulp flows to a revolving distributors feeding four flotation roughing cells.

Each cell is 25½ in. wide by 8 ft. 9½ in. long and is divided into eight air compartments; the bottom of the cells have a slope of 3 in. to the foot. The mineral-bearing froth is formed by admitting air at 7-lb. pressure into the air compartments, from which it is atomized by passing through four thicknesses of heavy twilled canvas. The air required for the eight roughing and two cleaning cells is furnished by a type HH Connersville blower, running at 200 r.p.m., with a capacity of 3.3 cu.ft. of free air per revolution. The froth from the roughing cells overflows into a catch launder on both sides the entire length of the cell; a Pohle air lift elevates the rough concentrates to the two cleaning cells on the same floor. These are of the same type as the roughing cells, and make clean concentrates, and middlings which are pumped by a direct-connected 3-in. Krogh centrifugal pump to the original mixing tanks. The correct amount of oil for the entire flotation process is fed into these middlings by a feed pump as the stream is split into each of the mixing tanks. The flotation tailings from the roughing cells flow to two 30x7-ft. Dorr thickeners, the overflow from which is returned to the flotation circuit, the underflow going to waste.

New 500-Ton Copper Concentrator of the National Copper Co., near Mullan, Idaho

The total horsepower for the entire flotation operation, including the air for the mixing tanks and the Pohle air-lift, is obtained from a 30-hp. motor; the consumption of oil is from 0.2 to 0.3 lb. per ton of ore, and one man per shift looks after the upper and lower Dorr tank floor, as well as the flotation floor. The flotation feed averages 0.8% Cu, flotation concentrates 16% Cu, flotation tails 0.17% Cu. The flotation concentrates, together with the concentrates from the tables, flow to an 8-ft. Callow tank,

the 1:1 spigot product of which flows to a 20x10-ft. tank fitted with an A Z agitator. The concentrates are collected in this tank; on one shift the agitator is run to keep the material of even consistency, when the concentrates are dewatered in a 44-in. by 9-ft. Kelly press, in which the moisture is reduced to 12%; the moisture in the press cakes is further reduced to 6% by steam drying. From the dryer floor the concentrates go direct to railroad cars.

Mill Recovery 85%

The ratio of concentration is approximately 16:1, the screen analysis of the concentrates being as follows: Passing 35-mesh, but retained on 48-mesh, 2%; retained on 65-mesh, 4.8; retained on 100-mesh, 8.8; retained on 150-mesh, 24; retained on 200-mesh, 12; passing 200-mesh, 48.4%. The total extraction of copper and silver (the ratio being approximately 3 oz. of silver to 1% of copper) is 85%, of which 30% is obtained by the tables and 55% by flotation.

Power for the mill is electric, generated partly by the company, the remainder being furnished by the North Washington Power Co. The rating of the various motors in the mill totals 615 hp. The principal motors and the mill equipment driven thereby are as follows: A 200-hp. motor running an 18x30-in. Traylor water-cooled Blake type crusher, a 48-in. Symons disk crusher, two sets of 16x48-in. Chalmers & Williams rolls, two 48-in. Symons pulsator screens, one 24-in. double-bucket belt elevator. A 300-hp. motor operates, by rope drive, four 8-ft. by 22-in. Hardinge mills, two 8-ft. by 48-in. Hardinge mills, and one bucket elevator. A 30-hp. motor drives ten No. 6 Wilfley tables, ten No. 4 Deister sand tables, five Callow screens, two bucket elevators. Another 30-hp. motor operates the Ingersoll-Rand compressor and Connersville blower that supply the agitating and frothing air. Besides these motors, there are four 5-hp. and three 10-hp. motors driving miscellaneous equipment.

Twenty-five men shifts are required for the daily mill operation, six in the dry-crushing department and 19 in the treatment plant. The operating force is distributed as follows:

CRUSHING DEPARTMENT (2 SHIFTS)

2 Men—Crushers.
2 Men—Rolls, screens and oiling.
2 Men—Helpers (picking quartzite from ore for Hardinge mill pebbles).

TREATMENT PLANT (3 SHIFTS)

3 Men—30-mesh Hardinge mills and Callow screens.
3 Men—60-mesh Hardinge mills and tables.
3 Men—Flotation department and Dorr tanks.
3 Men—Filter pressing, drying and loading concentrates.
3 Men—Laborers (general helpers).
2 Men—Shift Bosses.
1 Man—Repairs.
1 Man—Mill superintendent.

This labor at the prevailing rate in the Cœur d'Alene district amounts to $83 per day, or on a 500-ton basis, 16.6c. per ton. The mill has not yet been in commission long enough to determine what will be the cost per ton for wear on crusher plates, roll shells, mill liners, etc. This will undoubtedy be comparatively high, due to the nature of the ore. When running to full capacity, however, the total cost of milling will not exceed the engineers' estimate of 60c. per ton and owing to low oil and labor cost in the flotation department, and the fact that in practice it has been found unnecessary to heat the flotation-circuit water, it is possible that the treatment cost will be under this figure. The mill is in direct charge of J. W. Thompson as superintendent, and under the general direction of John Mocine, manager of the National Copper Mining Company.

Magnesite Mines of Greece

Magnesite ore in Greece, producing some of the finest magnesite in the world, is found in serpentine strata and vein beds. The most important deposits are situated in the northern part of the island of Eubœa, where the industry is centered, says *Daily Consular and Trade Reports.*

The production of Greek magnesite is mainly in the hands of three companies: The Anglo-Greek Magnesite Co., 24 Finsbury Square, London; the Société Hellenique des Mines and the Hellenic Magnesite Co., both with headquarters at Athens. The distribution of this magnesite, however, is controlled by the first-named company.

The Anglo-Greek Magnesite Co. (Ltd.) operates mines at Galataki and Afration, near Limni, Eubœa. At the Galataki mines the vein of ore exploited is known to be 1300 ft. long and 50 to 60 ft. thick. The ore is transported by a 4½-mile aërial railway, run by a 15-hp. steam engine, to Katounia, near the shore. At Katounia the different qualities of ore are segregated and are either exported in their natural state or undergo treatment in the seven gas ovens there. The output of each of these ovens reaches 10 tons of calcined and 4 to 6 tons of dry-kilned magnesite per day. At the Afration mines a vein 1140 ft. long and 10 to 16½ ft. thick is worked, and the ore transported to the ovens by a Decauville wire railway.

The Société Hellenique des Mines (now called the Financial Corporation of Greece, Ltd.), lately leased the Société des Travaux Publics et Municipaux and the Société Metallurgique Boeotia and now controls the production of mines at Mantoudi, Limni, Larimna, etc. The area owned by this company is 23,850 acres, and the principal mines operated by it are at Elafrosouvala, Koufala and Gerorevma. The Elafrosouvala vein ranges in thickness from 3 to 50 ft.; part of the ore of this mine is transported over a 23½-in. gage railroad to the Kymassi shore, where it is loaded into ships. The remainder of the ore is calcined in the ovens of the company at Fourni (whither the ore from the Gerorevma and Platoria mines is also sent), the equipment at this place consisting of one Schamatola oven for making calcined magnesia and a Mendheim 16-compartment oven for producing calcined magnesite and magnesite bricks.

The Hellenic Magnesite Co. obtains most of its ore from surface excavations near Aghia Triti, Eubœa, where the magnesite is found in talc schist veins. The ore is carried by a Decauville aërial railway to Pyli, 4 miles distant, where it is loaded into ships for exportation or stored for treatment in the 17 ovens there.

Statistics as to the output in 1912 are the latest obtainable. These show for the Limni mines of the Anglo-Greek Co. a production of 51,918 tons of raw, 18,356 tons of calcined, and 2163 tons of dead-burnt magnesite; for the Chalkis mines of this company, 2,642 tons of raw and 7822 tons of calcined magnesite. In the same year the Société Hellenique des Mines produced at its Mantoudi properties 31,670 tons of raw, 4467 tons of calcined, 1038 tons of dead-burnt, and 496 tons of brick magnesite. The Travaux Internationaux de Magnesite at Chalkis are credited with an output of 108 tons of raw magnesite; those at Atalanti, with 1000 tons of the raw. Figures of the Hellenic Magnesite Co.'s output in 1912 are not available.

New Smelting Works of Arizona Copper Co.--I

By Richard H. Vail

SYNOPSIS—The new works of the Arizona Copper Co., near Clifton, embodies some interesting equipment. It is a reverberatory smelting works, and one of the novel features is the agglomerating cone for mixing hot converter slag and siliceous fines to form a self-fluxing mixture suitable for charging into the reverberatory furnaces.

The new smelting works of the Arizona Copper Co. is situated on the San Francisco River, about two miles south of Clifton, Ariz., the new station of Smelter having been established on the Arizona & New Mexico R.R. at this site. The plant is at an elevation of 3500 ft., and is about 100 ft. above the bed of the San Francisco River. The new works is a reverberatory smelting plant, no blast furnaces having been erected, though space was saved for a blast-furnace department, should it later become necessary. There are three reverberatory furnaces, supplemented by eight Herreshoff roasting furnaces, and three stands of upright basic-lined converters.

The Arizona Copper Co.'s smelting plant is the newest in the Southwest, and represents in many ways the latest ideas in smelter construction, as well as presenting some novelties. The plant is also noteworthy in the unusual care that has been taken to insure continuous operation, a spare unit having been installed in practically every department beyond the ore beds; while the crushing, sampling, bedding and conveying systems are of such capacity that only 8 hours' operation will be required in each department to supply the roasting and smelting departments for the day; hence, there will be ample opportunity to make repairs.

The major portion of the company's copper production is from the concentration of its porphyry ores, which was undertaken in 1886, or nearly two decades before "porphyry coppers" became popular flotations. The company has always operated quietly and conservatively, having had no public stock-selling campaign. Consequently, the general public has no conception of it as a "porphyry copper," though it was one of the first companies to operate a disseminated copper deposit; also, few people have known that it has for nearly 20 years operated a leaching plant and an oxide concentrating mill, the tailing from which passes to the leaching department, where it is

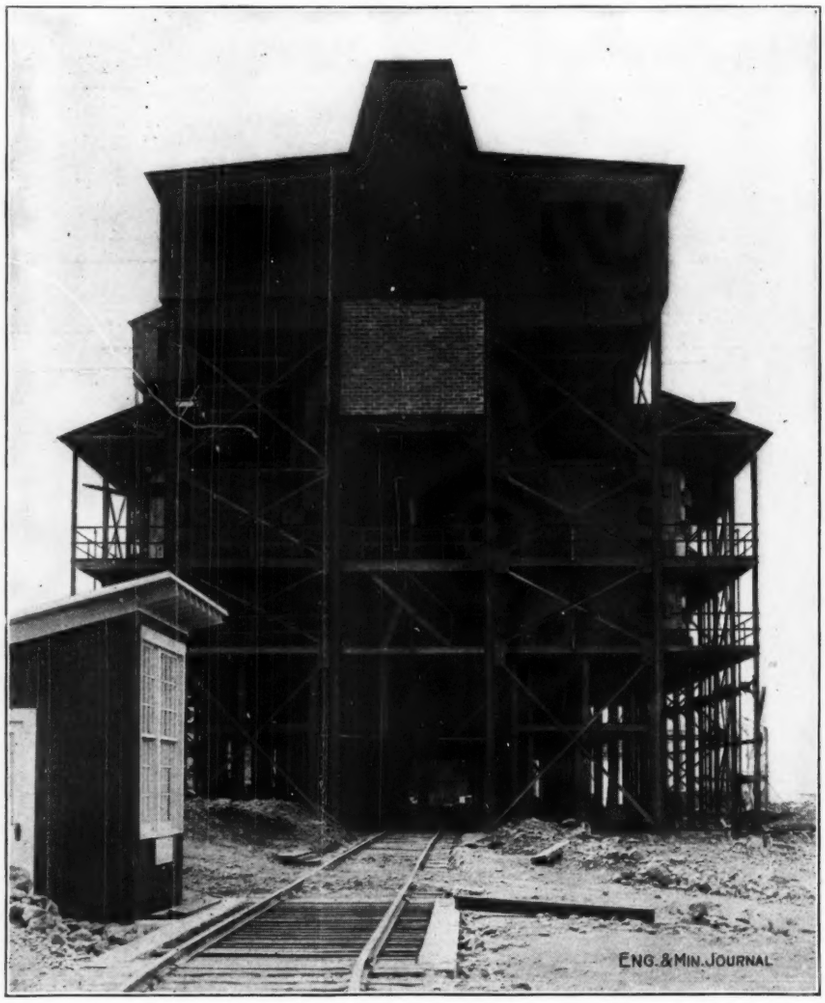
View of New Smelting Works, near Clifton, Ariz., from across the San Francisco River

Note—This description was written from notes taken during the summer of 1913, at which time the plant was not completed, but the data have since been brought uptodate through correspondence with local officials.

treated with sulphuric acid made on the property, and the copper precipitated with scrap iron.

The old smelting works in the town of Clifton was operated for over 40 years, and at the time of its closing, on Jan. 1, of this year, was probably the oldest continuously operated copper-smelting works in the West. Smelting was begun at this site in 1873, and the plant has been practically rebuilt several times. It has been the scene of some important metallurgical developments. From the use of water-sprayed copper plates, this plant developed the first water jackets used in copper blast-furnace smelting.[1]

The new smelting plant is, in the main, built of steel and concrete, the exceptions being the main stack, flues, and some of the accessory buildings, such as the mechanical shops, power house, etc. The works is laid out with a Messiter bedding system for the concentrates, this plan having been adopted on the basis of its being cheaper than the equivalent storage in bins and also as having the additional advantage of supplying a uniform feed for the roasting and reverberatory furnaces. The concentrates smelted are of several grades; the concentrates from the No. 6 or Morenci mill average about 16% copper; those from the No. 4 mill, 10%, and the concentrates from the oxide mill about 8% copper. The new plant is served by the Arizona & New Mexico R. R., which has standard-gage tracks, but an additional rail has been laid to permit narrow-gage cars to reach the receiving bins. The transportation system within the works is of standard gage and comprises about 1½ miles of electric-trolley track and four miles of steam-railroad track. On the latter, near the receiving bins, a 150-ton Fairbanks scale is installed to weigh all ores or bulk freight entering the works.



ROASTER BUILDING, CONTAINING EIGHT HERRESHOFF ROASTERS

At the east side of the plant are the steel receiving bins for ores and concentrates; the ore bins have a capacity of 1000 tons and the concentrate bins hold 1500 tons. The ore bins are provided with "up-cutting" gates to permit easy regulation of the discharge to No. 1 conveyor, which takes the coarse ore to an 18x36-in. Farrel crusher. The No. 1 conveyor has a 30-in. belt, while 20-in. belts are used on all other conveyors in the plant; the conveying system comprises 22 belts, having a combined length of over 1⅜ miles. The concentrates are taken from the receiving bins by a separate group of conveyors, leading to the south half of the sample mill.

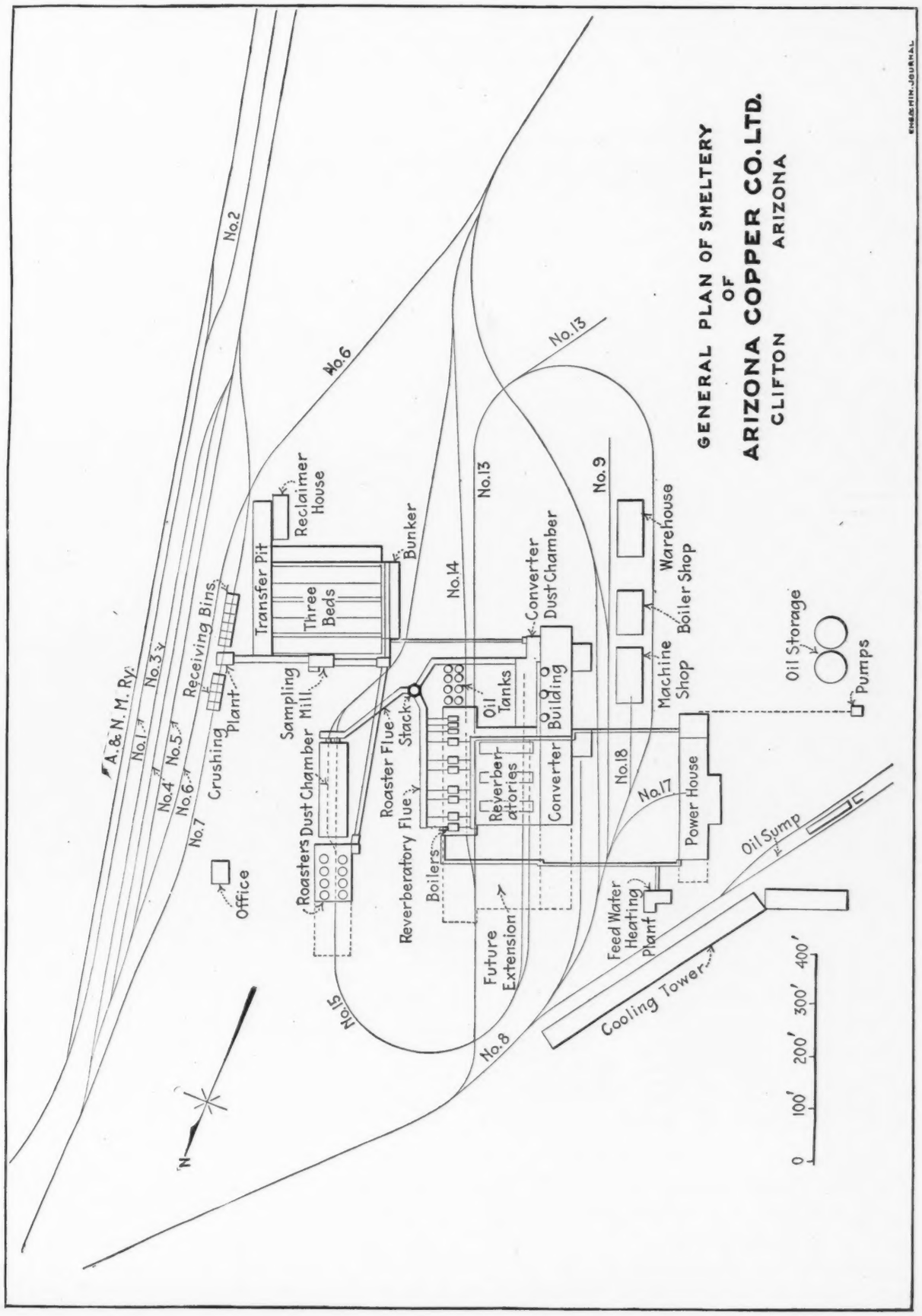
SEPARATE ORE AND CONCENTRATE SAMPLERS

The concentrate- and ore-sampling mills, while entirely separate, are contained in one building; there is no inflammable material in this building, which has concrete floors and steel frame, and concrete-and-steel stairways; all chutes are of steel and were made on the ground.

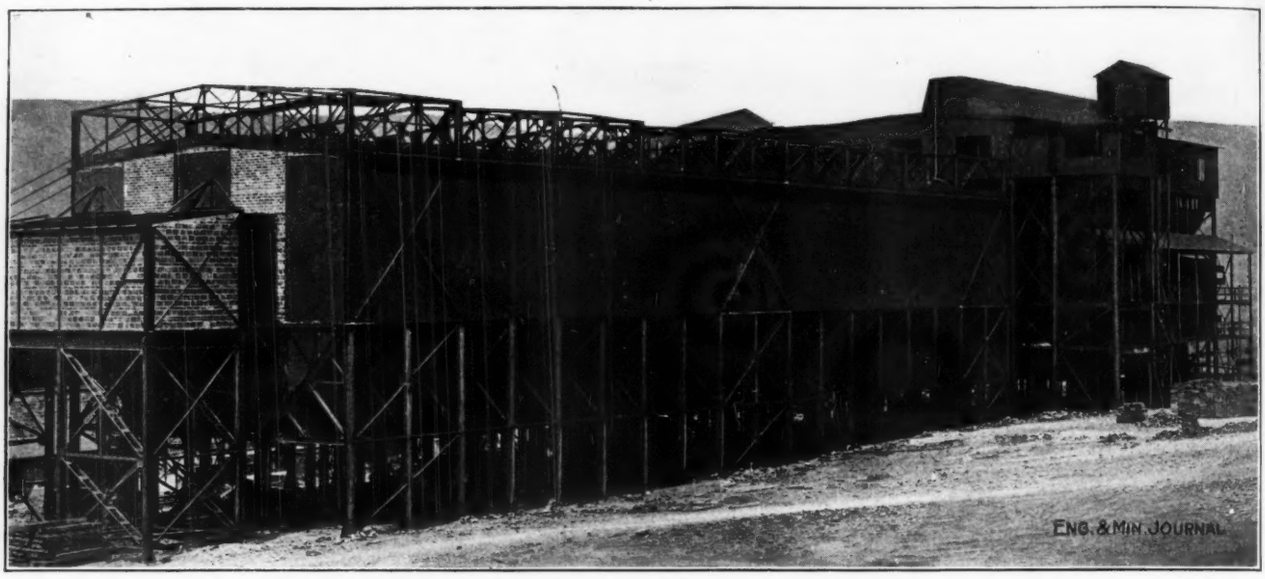
The coarse ores, after being reduced to 2½ in. in the Farrel crusher under the receiving bins, are conveyed to the north half of the sample mill and pass to a set of 12x48-in. Chalmers & Williams rolls, crushing to 1¾ in. The stream of ore is then cut by a 42-in. Snyder sampler or this cut may be omitted and the ore further crushed in a set of 16x42-in. Chalmers & Williams rolls; then another 42-in. Snyder sampler cuts $\frac{1}{10}$ of the stream. A 6-in. bucket elevator raises the sample to a shaking feeder, delivering to a set of 12x24-in. rolls. The sample is again cut in a 27-in. Snyder sampler, delivering $\frac{1}{10}$ to a steel sample safe. The concentrates are sampled by Vezin samplers.

The product from both mills is taken to a sample-grinding room in an adjoining building. Here are two 2x6-in. Sturtevant roll-jaw crushers and four Braun disk pulverizers, driven by a 5-hp. motor; provision is made for the installation of two additional pulverizers when required. A 4x4x2-ft. steam drying oven is provided, and

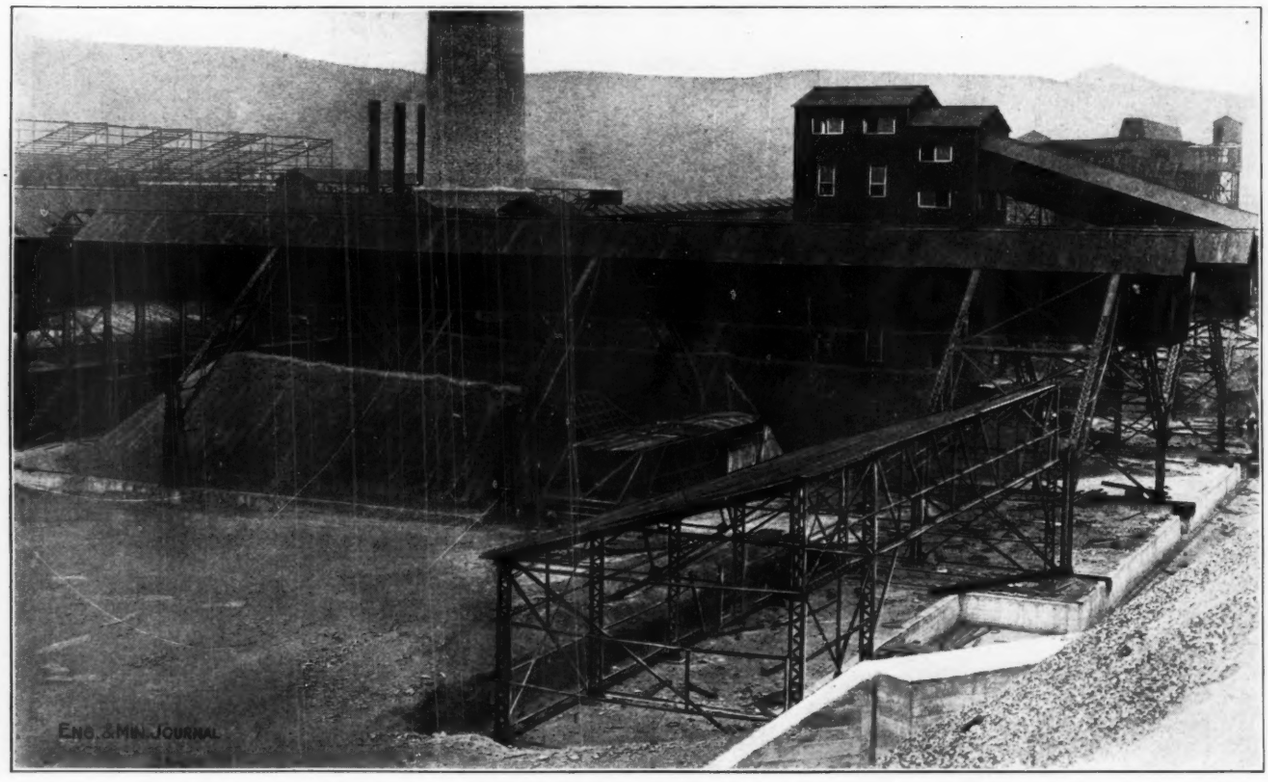
[1] "Copper Blast Furnace Development," by E. P. Mathewson, "Eng. and Min. Journ.," May 27, 1911; "The Copper Queen Mines and Works," by James Douglas, "Trans.," I. M. M., 1913.


GENERAL PLAN OF SMELTERY
OF
ARIZONA COPPER CO. LTD.
CLIFTON ARIZONA
A. & N. M. Ry.
No. 1
No. 3
No. 4
No. 5
No. 6
No. 7
No. 2
No. 6
No. 13
No. 14
No. 9
No. 18
No. 17
No. 15
No. 8
Receiving Bins
Crushing Plant
Transfer Pit
Reclaimer House
Three Beds
Bunker
Sampling Mill
Roasters
Dust Chamber
Roaster Flue
Stack
Reverberatory Flue
Boilers
Reverberatories
Converter
Converter Dust Chamber
Oil Tanks
Building
Machine Shop
Boiler Shop
Warehouse
Oil Storage
Pumps
Power House
Oil Sump
Feed Water Heating Plant
Future Extension
Cooling Tower
Office
N
0 100' 200' 300' 400'

four circular cast-iron bucking plates, 36 in. in diameter by 2 in. thick, for shift samples. The sample pulps are delivered to the assay office, which is not shown on the



THE ROASTER DUST CHAMBER, CONSTRUCTED OF STEEL AND HOLLOW TILE



MIXING BEDS, RECLAIMING MACHINE AND SAMPLING MILL

general plan; it is at the north side of the works, just inside the loop made by the calcine track.

BEDDING SYSTEM

The crushed ores from the north sampling mill are delivered into steel bunkers, holding about 4000 tons and serving the converters and agglomerating cones. The concentrates and such crushed limestone or other products to be delivered to the roasters are taken by belt conveyors to the mixing beds, which cover an area of 200x250 ft. There are three beds of approximately 4000 tons capacity each; these with the above mentioned bunkers and the receiving bins give a total storage of about 18,500 tons. The beds are served by the usual conveyors and trippers and the concentrates are reclaimed by Messiter reclaiming machines.

As the reclaimed concentrates pass to the roaster department, they are automatically weighed by a Merrick weightometer installed on conveyor No. 11, leading into

the roaster building where a cross belt delivers them to conveyors that serve the two rows of Herreshoff roasters. These are the new large-type furnaces[2], with columns and arms cooled by air under pressure. The furnaces have six roasting hearths and a drying hearth on the top. The steel shells are 21 ft. 6 in. in diameter and 18 ft. high. Each furnace is estimated to require 3 hp. for operation and 2400 cu.ft. per min. of air at 1¾ oz. pressure. The air is supplied by one of two 55-in. Buffalo conoidal fans direct-connected to 25-hp. squirrel-cage General Electric motors; operating at 685 r.p.m., the set delivers 22,000 cu.ft. of air per minute at 1¾ oz. pressure.

The capacity of the roasters is between 70 and 100 tons per day and the calcines are removed in larry cars of 20-ton capacity, made by the Kilbourne & Jacobs Manufacturing Co. There are three of these cars. They have two 4-wheeled trucks with Schoen wheels; power is supplied through a G. E. 52 motor. On the way to the reverberatory furnaces the calcines are weighed on a Fairbanks 40-ton track scale, with type-registering poise.

The gases from the roaster pass to a dust chamber, 48x180 ft. long, having a cross-section of 1325 sq.ft. with a double-hopper bottom. The structure is of steel and hollow tile and has a roof of No. 11 sheet iron. In the dust chamber there are about 280 miles of No. 10 steel wire and about four miles of ⅜-in. chain, from which the wires are suspended. The wires are hung at 4-in. centers and extend well down into the hoppers. A steel-and-hollow tile flue, with No. 11-gage iron roof, conducts the roaster gases to the main stack. The main stack is built of perforated radial brick and is 300 ft. high and 22 ft. inside diameter at the top. The stack has a 4-in. lining of firebrick laid in acid-proof mortar. The top 75 ft. of the stack is pointed on the outside with a mortar of sodium silicate and asbestos fiber; the lighter color, noticeable in the photograph, on the upper part of the stack, is caused by this feature.

(*To be continued*)

Standard Consolidated

The Standard Consolidated Mining Co., Bodie, Calif., shows a decrease of cash balance amounting to $22,021 for year ended Feb. 23, 1914, after payment of dividend No. 121, amounting to $44,598. Total dividends since 1879 amount to $5,274,407 from bullion products valued at $16,457,838. Although one statement ending Jan. 31, 1914, shows a gain of $7138, it is apparent that no money was made from mining operations as the superintendent's statement of accounts for the same period shows a loss of $2651. Active operations were suspended in September, 1913. There is a possibility that operations may be resumed on a small scale if some agreement can be made with adjoining property owners for a new ore supply.

During the period under review, the mine produced 6342 tons of ore averaging $13.08 per ton by assay, and at a cost of $10.50 for mining, of which $4.181 was for development and $6.319 for stoping. This ore was milled at a cost of $1.644 per ton, consisting of $1.033 for labor, 33.1c. for supplies and 31c. for power. Owing to scarcity of ore, the mill was not run at full capacity at any time. The cyanide plant treated 16,267 tons, of which 6156 tons were mine ore and 10,151 tons were from the tailings pond, the cost of treatment in this plant was $1.805 per ton. The total cost per ton of mine ore was $16.97 and of pond tailings, $2.79 per ton of which 58c. was for scraping. The average assay of pond tailings was $5.43 per ton. In the cyanide plant, there were 420 tanks charged with material, 19% of which was +100 mesh, moisture averaged 69%. In filtering, 1.1-in. cakes were formed, an average of 3.4 hr. were required for forming cake and 2.7 hr. for washing. Zinc-box solutions averaged $1.72 at head and 2c. at discharge. Cyanide charge was 1.7 lb. and lime, 0.38 lb. per ton of solution. The actual consumption of supplies was as follows per ton of ore: Tube-mill pebbles, 0.8 lb.; cyanide, 1.25 lb.; lime, 19.4 lb.; lead acetate, 0.11 lb.; and zinc, 0.6 lb.

Measuring Compressed Air for Cost Distribution

By B. B. Hood*

Compressed air is used around mines for purposes other than rock drilling, and in order to apportion the costs fairly a measurement of the various quantities is usually desirable. Various meters are obtainable that will do this, but they are expensive and not always at hand. At one of the mines in northern Michigan, it was necessary to ascertain approximate figures of air consumption as a basis for cost distribution.

One steam-driven, 5000-cu.ft. Nordberg compressor supplied the air for the mine. This was practically new and in good order. The pressure of 75 to 80 lb. was kept on the mains for 120 hr. per week. A week was taken for the period during which measurements were to be made. The air delivered by the compressor was consumed as follows: (1) Pipe-line losses; (2) Saturday afternoon blowoff; (3) blacksmith shop; (4) two rock houses; (5) rock drills and blowing powder gases; (6) underground pumps.

To account for the large line losses at the time of this test, it may be well to describe the lines. The surface air lines consisted of nearly 6000 ft. of 8-in. pipe buried in the ground. A large part of it was galvanized spiral-riveted pipe. This failed as an air pipe in two ways. The ends of each length of pipe were fitted with pressed-steel flanges. The faces of these flanges were not true and the surfaces were too small to hold a gasket after the latter had become saturated with oil; consequently they blew out and had to be often repaired. The continual expansion and contraction of the line, due to its having to carry hot air for some hours and then cool off, loosened the riveting. Some pieces of pipe would have small leaks throughout their entire length. These failures were most apparent in the 500 ft. nearest the compressor. The underground air lines were practically tight. As they were exposed to inspection, this was verified and no account of their loss was made.

The compressor had a minimum capacity of 845 cu.ft. of free air per min. Repeated attempts to make it run slower than this were not successful, as the flywheel would not carry it over centers. This was more than the pipe-line loss, so one afternoon between 5:30 and 6:45, when the compressor was usually shut down, a blowoff valve was adjusted to allow the 845 cu.ft. per min. at 78-lb.

[2]"Eng. and Min. Journ.," Jan. 31, 1914.

*Mining engineer, Sudbury, Ont.

gage pressure to escape. The air mains were shut off from the compressor during this adjustment, then they were charged with air at 78 lb. and the increased number of revolutions of the compressor noted over a period of 30 min. From this it was computed that the surface-line loss was 205 cu.ft. of free air per min. Figuring that the pressure was maintained on the lines for 120 hr. per week, this would amount to 1,480,000 cu.ft. of free air, which was the line loss during that period of time. The underground lines were shut off during this test because all of the machine valves were open to blow powder smoke.

No air was used underground from Saturday noon until Monday morning, but it was required for other purposes until 11 p.m. Saturday evenings. At times the demand would fall below the minimum capacity of the compressor, and in order to keep the engine running it was necessary to blow off some of its product. A small receiver was made of pipe fittings. This was furnished with an orifice 1½ in. in diameter in a $\frac{3}{16}$-in. plate, a thermometer, and a pressure gage. The instrument was used as a blowoff one Saturday afternoon. Compressed air was admitted into the receiver through a valve and was controlled to meet the requirements of the compressor. The pressure and temperature of the air in the receiver were taken at intervals. From these readings it was computed that the total free air blown off during the afternoon and evening was 338,000 cubic feet.

The air used by the blacksmith shop was measured by means of pitot tubes placed in a tube 20 in. long with a true 1-in. bore. The pitot tubes were made of $\frac{1}{16}$-in. outside diameter copper tubing. They were soldered into a ⅜-in. to ½-in. pipe bushing, so that when the latter was screwed into a tapped hole in the side of the 20-in. tube, they extended into the tube ¼ in. One of them faced the air current while the other was square with it. They were connected to a glass U-tube made of two steam-gage glasses connected at their lower ends with rubber hose. Water or mercury was used to determine the velocity head of the current of air. The 20-in. tube was fitted with a thermometer and a pressure gage some distance from the pitot tubes and behind them so that eddy currents were kept from the tubes. The following formula was used to compute the air flowing through the tube:

$$Q = 135 \sqrt{\frac{H\,(P + 14.7)}{t + 460}}$$

Where

Q = Cubic feet of free air per min. at 60° F. and 28.5 in. barometer flowing in the 1-in. tube;

H = Height of water in inches representing velocity head. (When mercury was used, the readings were multiplied by 13.6, the specific gravity of the mercury.)

P = Gage reading;

t = The temperature of the compressed air (° F.).

The instrument was set in the air line some little distance from the blacksmith shop, so as to have between it and the shop some receiver capacity in the shape of pipe line. This took off some of the sharp peaks in flow caused by the drill sharpener and the hammer. It was found that the drill sharpener, furnace and forge working 36 hr. per week used 550 cu.ft. of free air per min., or 1,188,000 cu.ft. per week; the other forges in 18 hr., at 160 cu.ft. of free air per min., used 172,800 cu.ft.; the hammer in 6 hr., at 720 cu.ft. of free air per min., used 259,200 cu.ft., giving a total for the shop per week of 1,620,000 cu.ft.

Air was supplied to two rock houses to operate chute gates and drop hammers. On Saturday, from noon until 11 p.m., compressed air was used by the rock houses and for 2¾ hr. by the blacksmith shop. On the Saturday afternoon of the week of the test, the following was obtained: Total air compressed from noon till 11 p.m., 670,000 cu.ft.; blowoff, 338,000 cu.ft.; line loss, 118,000 cu.ft.; blacksmith shop, 27,000 cu.ft., leaving for the amount consumed by the rock houses in 8 hr. actual operation, 187,000 cu.ft. In the 72 hr. per week of rock-house operation, about 1,683,000 cu.ft. of air was, therefore, required.

Most of the rock drills were of the 3⅛-in. piston type. Arrangements were made to suspend pumping for one shift during the week, and make it up during the next shift. During that time there were 22½ drill shifts worked. The following results were obtained: Total air compressed during the shift, 1,439,000 cu.ft.; line loss, 120,000 cu.ft.; blacksmith shop, 270,000 cu.ft.; rock houses, 140,000 cu.ft.; difference consumed by drills, 909,000 cu.ft. This was used both for actual drilling and for blowing the powder smoke. The mine had good natural ventilation, so that the compressor was shut down soon after drilling ceased. If the drill machines operated on an average of 4½ hr. actual running time during the shift, the figures reduce to 150 cu.ft. per machine per min., which is a figure often used when estimating compressor capacity required. During the week in question, there were 111¼ machine shifts worked, which required, on the basis of the figures, 4,490,000 cu.ft. of free air.

Pumping water with air is expensive. One of the mine pumps had been previously tested. An Ingersoll-Sergeant 12 and 14¼x14-in. compressor furnished air for a No. 10 Cameron mine pump, 14 and 8x13-in. No other uses were made of the air and the air line in this case was tight. Indicator cards were taken from both the air and steam cylinders of the compressor. The valve adjustments were good and the pistons tight. The total pumping head of the pump, including suction and pipe friction, was 103.1 ft. The water pumped was measured by a 4-in. orifice in a tank at the surface. The overall efficiency from steam indicated horsepower to useful work done on the water was only 6.81%. In the present case, the amount of air used by the mine pumps during the week was determined by difference, as is shown in the following table, which also gives the complete air distribution for the week.

	Cu.Ft. Free Air	Per Cent. of Total Compressed	Per Cent. Total Delivered by Mains
Total air compressed....	19,200,000	100.0	....
Airline losses	1,480,000	7.7	....
Blowoff	338,000	1.8	....
Blacksmith shop.....	1,620,000	8.4	9.3
Rock houses.....	1,683,000	8.8	9.7
Rock-drilling machines.	4,490,000	23.4	25.8
Underground pumps....	9,589,000	49.9	55.2

It is true that succeeding weeks might not have had the same distribution percentage, but to obtain an accurate distribution for the cost sheet of each month would take an expensive equipment, which, in most cases, would hardly be warranted. To make tests similar to the above every three months is not expensive and is much more accurate than merely guessing at a division.

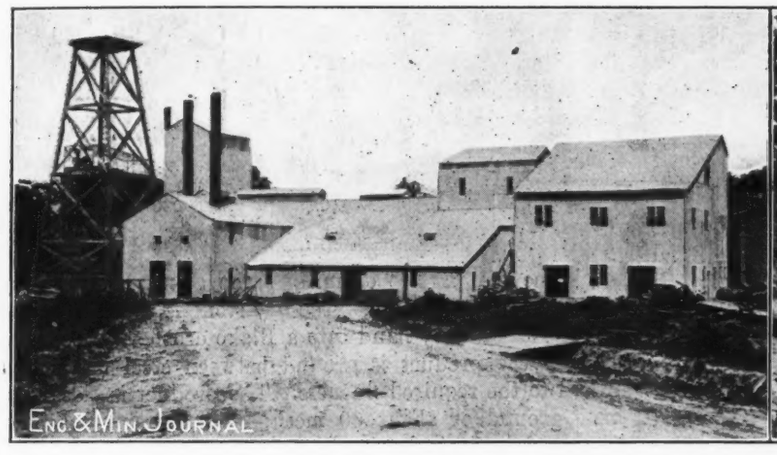
The Tripoli Industry

By C. H. Plumb*

SYNOPSIS—Geology, history, quarrying and treatment methods of the tripoli deposits of southwestern Missouri. Tripoli an unexcelled filtering medium. Large blocks for filters becoming scarce. Oklahoma Tripoli Co. claims to have a method of manufacturing artificial filtering stones out of ground tripoli. Costs and future of the industry.

Among the different abrasive materials, such as fuller's earth, volcanic ash, carborundum, silex and infusorial deposits, there is found tripoli, an absorbent as well as an abrasive rock, which is mined or quarried commercially in the United States only in the immediate vicinity of Seneca, Newton County, Missouri.

Tripoli is a fine-grained, exceedingly porous variety of siliceous rock of light weight, with great absorbent qualities. When first mined or when the "sap" is in the stone it is soft and easily cut with a knife, but when thoroughly dried is harder and more compact. When immersed in water the stone, no matter of what age, again becomes soft and easily worked.



New Mill for the Oklahoma Tripoli Company

Tram from Quarry

Although found in many different places in Newton County, Mo., and Ottawa County, Okla., there seem to be two main ranges in which the workable deposits lie, one running from Racine, Mo., in a southeasterly direction and one running southeast from Seneca, Mo., and also northwest into Ottawa County, Okla. Isolated deposits are found at Wyandotte, Fairland and Grove, Okla., and near Neosho, Mo. This trend of the deposits seems to coincide with the trend of the lead and zinc deposits of the Joplin district adjoining.

Geology

The deposits of tripoli are found in the Boone formation of the Mississippian series of the Carboniferous age. This is the same formation that carries the lead and zinc deposits of the Joplin district and consists mainly of limestones and cherts.

The tripoli is generally found at a shallow depth under the surface soil and loose flint and is in massive form, not lying in regular strata or showing any regularity of deposition. The deposits are in the nature of blanket veins with no regular bedding planes, joints or seams. While the deposits as a whole are flat, there are many local irregularities and waves to the beds. The deposits vary from 1 to as much as 18 ft. in thickness.

Tripoli is almost pure silica and undoubtedly formed from the decomposition or weathering of flint chert, samples having been found grading from hard "knife-blade" flint into pure soft tripoli with an entire absense of fossils and diatoms. The red clay has in places stained the tripoli to a rose color while in others it is a pure white. In some instances a beautiful, banded structure is found. Occasionally the deposits are of such massive character and free from joints and seams that blocks several feet square can be quarried, but generally the deposits are broken and full of irregular seams and joints. The deposits that have been worked are on the top of flat hills or plateaus broken by small draws, where croppings are usually found and no deposits have been worked where there is more than 10 to 12 ft. of surface overburden.

Flint balls or boulders and seams of flint and clay are frequently found in the formation, but where the tripoli is used for flour do not generally render the deposit unfit for working.

Development of the Industry

Tripoli was first exploited about 25 years ago and a number of small companies operated near Seneca, Mo., quarrying the rock and manufacturing filter stones and scouring bricks. Later when its value as an absorbent and abrasive was understood, the American Tripoli Co. was organized and bought out the small companies.

This company has a mill of about 30 tons capacity and a filter plant at Seneca and is quarrying rock from its land north of Seneca and from the Modoc Reservation in Oklahoma.

*Mining engineer, Butte, Mont.

The Racine Tripoli Co. is operating a small mill at Racine, where water power is used. The Clean Cleaner Co. is quarrying rock and shipping it unmilled to its plant in Indiana. The Oklahoma Tripoli Co., the youngest in the field, has quarries and a mill one mile south of Peoria, Okla., and five miles northwest of Seneca.

Tripoli is a light, porous stone resembling "cotton rock" or chalk and found in white, cream and rose colors. A perfectly dry piece will absorb about 50% of its own weight in water. When mined it will run from 25 to 35% heavier than its dry weight. The specific gravity of one sample from the Oklahoma Tripoli Co. was 2.14, equivalent to 133.5 lb. to the cubic foot or 15 cu.ft. to the ton. As there is no standard of quality or recognized grade of purity for tripoli, only a comparative analysis of deposits now being worked can be made.

The following are five analyses of tripoli quarried near Seneca:

	1	2	3	4	5
Silica	98.28	98.100	98.10	98.35	99.30
Alumina	0.17	0.240	0.24	.....	.....
Iron oxide	0.53	0.270	0.27	1.20	0.15
Lime	Trace	0.184	0.33	0.08	0.07
Potash	0.17	.....	0.23	.....	.....
Soda	0.27	0.230	1.17	.....	.....
Ignition	0.50	1.160	.....	0.60	0.50
Organic matter	.....	0.008	.....	Trace	Trace
Total	99.92	100.192	100.34	99.23	100.02
Specific gravity				2.02	2.14
Absorbent qualities				58.9%	52.67%

Note—Samples 1, 2 and 3, assays from U. S. Geol. Surv. report. Sample 4, from quarry of American Tripoli Co. Sample 5, from quarry of Oklahoma Tripoli Co.

Black specks are encountered in some of the quarries, but these have been proved by analysis to be organic matter which partially disappears in drying and is not noticeable when ground; it does not impair the value of the product in the least. Pits on the McConkey land north of Peoria, Okla., show a pure white tripoli which slacks after exposure to the air; this is due probably to the ageing of the stone and fatally impairs its value.

Uses

Tripoli was first used for scouring bricks, blotters and filter stones, but the supply of stone suitable for filter purposes has become so depleted that this is only a minor use at the present time. The bulk of the product is tripoli flour which is used mainly as the abrasive element in scouring soaps, such as Clean Cleaner, Bon Ami, Okamo, etc. As tripoli is insoluble it is not used in soap powders. It is also used, however, with emery dust, in nail polish, as a filler for paper and rubber, and for all kinds of polishing and buffing. Finally it takes the place of fuller's earth for lubricating oils.

Quarrying

The usual method of quarrying tripoli has been to remove the surface overburden by means of plows and scrapers until a face is exposed and the deposit opened up. The tripoli is then shot with charges of black powder, broken up with picks, loaded with forks into wagons and taken to the dry sheds where it is air dried for a period of three to four months before milling. The American Tripoli Co. has about 15 double-deck dry sheds, approximately 30x150 ft., where the tripoli is stored for drying.

When the rock is quarried for filter stones, channels are cut with picks along the seams or joints and holes drilled below the block and filled with unslacked lime. The lime absorbs the moisture from the stone and in swelling breaks out the blocks in the required size. In places the stones are sawed out in the pits to the required size.

The Oklahoma Tripoli Co. has its mill situated near the quarry with a tram running directly into the pits. The stripping is to be done with steam shovels and the tripoli sorted and loaded directly into the tram cars and hauled to the mill. The dry sheds are eliminated by the use of a drier in the mill.

Stones for Filtering

The manufacture of the filter stones is a simple matter. The green stone full of moisture is taken to the mill and sawed into blocks of approximate shape and size by means of a circular saw set with removable teeth, this made necessary by the great wear on the saw. After drying, the blocks are put on lathes and turned to the required size by means of disks faced with carborundum. Some of the machines are operated by foot power. Holes are bored in the blocks that require it and the filter is ready for market. The presence of black specks of organic matter or the presence of sand pits destroys the value of the material for filter purposes. None of the present operators has been able to make filters from the tripoli flour, as the binder destroys the porosity of the filter. The Oklahoma Tripoli Co. claims, however, to have discovered a process of adding a binder and burning in a retort, producing filters of any size and density. If this claim is proved, the filter business of the country will be revolutionized, for it is well known that tripoli excels all other products for filter purposes.

Milling

In the old process of milling the stone, practiced by the American Tripoli Co., the dry stone is taken from the wagons and fed by hand into a Blake crusher. From the crusher the product is ground between steel buhrs and bolted to the required fineness. The product is classed as once ground or about 60 mesh, twice ground or about 150 mesh and air float or what is saved by the dust collectors. The product is packed by machines into sacks or barrels lined with paper and loaded directly into cars for shipment.

The Oklahoma Tripoli Co. is just completing a mill of entirely different character. The stone is dumped automatically from the tram cars into a three-compartment bin of 1000 tons capacity, arranged for the three different colors. From this bin the stone is fed into a gyratory and crushed to a size of 1 in. An elevator takes the crushed stone up into a 100-ton hopper which feeds into a cylindrical, revolving drier 8 ft. in diameter and 56 ft. long. A furnace, fired with wood, furnishes the heat which passes through a 3-ft. cylinder in the center and back through between the two cylinders to an exhaust fan. The dried product is discharged at the rate of about 10 tons per hour into a roll-hammer crusher. An elevator takes the crushed stone up into a small bin which feeds it into a tube mill. From the tube mill the product is elevated again into an air separator where the flour is blown through large pipes into settling chambers. The oversize or imperfectly ground product falls from the air separator into a screw conveyor and is returned to the tube mill. The flour is blown into bags and through these into the storage bins. That which is blown through the bags is collected by dust collectors. The

finished product from the mill nearly all passes through a 200-mesh screen. The air float is an impalpable powder and is used for silver polish. This company has also perfected a process of washing or bleaching the flour to a pure white.

Production Costs

The production of tripoli increased from 200 tons in 1888 to 7680 tons in 1912. The value of the filter stones depends entirely on the size and shape. The value of the flour is given as $7.50 per ton, f.o.b. Seneca. The air-float flour brings as much as $30 per ton. The cost of quarrying and delivering to the mill dry by the old method is about $1.30 per ton. The cost of milling and sacking is about $2.70 per ton, making a total cost for quarrying and milling of about $4 per ton. The methods to be employed by the Oklahoma Tripoli Co., if successful, will reduce the cost one-third to one-half.

Markets and Future Promise

The market for tripoli, aside from filter stones, has apparently up to the present time been limited. A careful investigation of the real market, however, has shown that all the market needed was its development and that the consumers waited for the supply. If filters can be made from the flour an almost unlimited field is open. Tripoli combines such valuable qualities that new uses for the stone will readily be found. The supply of the stone apparently is almost unlimited, although a great many of the deposits are of poor quality and of no value. The capital required to erect a modern mill is in the neighborhood of $50,000, a sum that will deter almost all investors until the market has reached larger proportions.

I am indebted for many of the facts and figures here presented to U. S. Geol. Surv. Bull. 340, by C. E. Siebenthal and R. D. Mesler.

Abandonment of Mining Claims--Sufficiency of Location Notice

Whether a person who has located a mining claim has abandoned it is a matter of intention to be determined from a consideration of his acts, as well as by any statements that he may have made. Unless an abandonment is made with fraudulent purposes, the locator may make a valid relocation on a claim including part of the ground covered by the abandoned location. "If the owner of a claim abandons any part of it from any improper motive, such, for instance, as to escape the annual assessment, and thereby projecting, or attempting to project, his rights one year into the future without doing his annual assessment work, then it well may be that such abandonment would be held to have been prompted by ulterior motives, and therefore void." A location notice written on a piece of white paper placed on a stick and partly covered by a rock to prevent the wind from blowing it away cannot be regarded as having been insufficiently posted, as a matter of law. (Colorado Court of Appeals, Emerson vs. Akin, 140 *Pacific Reporter* 481.)

The Consumption of High Explosives (dynamite, nitro glycerine, dynalite, gun cotton, etc.) in the United States in 1912, as reported by the U. S. Bureau of Mines, was 89,703,081 pounds.

The Fundamentals of Mining Efficiency

By Wilber Meyers*

Efficiency in mining is as old as the industry itself. It is attained by the systematic analysis of existing conditions with continual study of how to improve these conditions so as to make operations safer and more productive for the same expenditure—this, combined with a common-sense attitude toward the ever-occurring emergencies that are a part of the business.

There are certain fundamental principles of efficiency that will apply whether mining is being carried on for coal, iron, gold or any other substance. The nature of mining makes efficiency particularly important. The policy of letting well enough alone because a routine management is paying small profits, is unreasonable when it is remembered that the wealth of the property is being exhausted and that there is no future chance to recover the money lost from year to year in producing at a higher cost per ton than was absolutely necessary. The main avenues of cost in any mine are labor and supplies; there are other expenses that must be met, such as taxes, insurance, royalties, personal injuries, legal expense in connection with damage suits, etc., but the cost of labor and the cost of supplies are the two great factors in mining costs, labor being the greatest of these two. One of the first necessary operations in introducing an efficiency scheme is to secure the good will of the workmen, since a contented workman in full sympathy with progressive ideas is much better material to work on than one suspicious and dissatisfied, antagonistic to innovations, which he fears are part of some new scheme to get the best of him. It is peculiarly necessary to get the good will of mine employees, since they work in isolated places, incapable of constant supervision. While it may be true that their work can be gaged by results obtained, yet these results will often be the maximum of the second- or third-class workman, the best workmen being afraid to let themselves out to their full capacity for various reasons. The management could do something to win and hold the good will of its workmen by getting their viewpoint, based on personal knowledge of working and living conditions.

Better light in the mine would be of benefit to the miner, eliminating some of the hazards surrounding his work and increasing productiveness, since he could detect and secure dangerous places more quickly, facilitating his work in different ways; it would help not only the miner but also the operator. Better ventilation, good drinking water, sanitation; all these have a direct bearing on a miner's comfort and safety, and incidentally on his productiveness, for as soon as the workman sees that the management is improving things for his benefit, he will begin to coöperate and his good will is won.

Harmony between different departments is another fundamental requisite of efficiency. Friction wastes power with men as well as in machinery. Sometimes there exist petty jealousies between the practical miner who has obtained his knowledge by years of experience and the engineer who has graduated from college after a four- or five-year mining course. Both types of men are necessary and working in harmony each helps the

*Negaunee, Mich.

other, while the company gets the best results from both. Sometimes the men at the shaft-top fail to work together with the men below, signals are misinterpreted, hoisting is delayed, etc. A smoker or concert occasionally, even a picnic, will get the men together in a happy frame of mind and eliminate a lot of petty jealousies.

One great aid to efficiency is the bonus or premium system, or profit-sharing with the employees; this identifies the interests of the workmen with the interests of the company. Such a system properly administered will enable the miners to earn more money per day and the company to produce at a lower cost per ton.

Education of the workmen is of the greatest importance. Either the boss or a skilled fellow employee as a companion, can show the green workman how to obtain a maximum result with the minimum expenditure of labor and also how to detect and secure dangerous places. Racial characteristics can be taken advantage of in this way, thus an old experienced Italian could have a younger man of his own nationality put with him to good advantage. If increased pay is given for increased production, this plan will stimulate both men to their best.

A suggestion box to enable the more intelligent workmen to submit to the management plans for improvements in methods often yields practical and economical ideas. If these are paid for and proper credit given to the workmen submitting them, it is an incentive to draw out the best working ideas.

If the foremen of different departments where the work is similar, are made to hand in to the office daily reports made out on standard blanks, a comparison of production and of accidents under each foreman can be made and friendly competition stimulated among the foremen, especially if the reports are known to be the basis for promotion.

Standardizing equipment and supplies will tend to reduce the quantity of supplies carried in stock and the amount of money tied up at any one time, and will facilitate repairs, inasmuch as the workmen will become acquainted with the kind of supplies needed and used and transfers of both equipment and supplies can be made from one part of the mine to another. If tracks of different gage are used for tramming, there must of necessity be various sizes of equipment such as cars, motors, etc., and this equipment would not be interchangeable, whereas if all tracks are standardized, changes can be effected readily. Again, trolley wire may be either grooved, figure-8 or round; if two or three of these sections are used, there will usually be necessary two sets of supplies to accompany the wire; while if one kind is used throughout the mine, both on the surface and underground, there can be no misunderstandings when trolley wire is ordered.

Recovering timbers, rails, switchpoints, frogs, rail spikes, pipe, trolley wire, hangers, etc., from places that are to be abandoned, or caved, instead of allowing them to be buried, will materially decrease the total expenditure for supplies. If supplies are standardized, this recovered material can be used at once, being already underground, and a saving of time secured, because new supplies would have to be taken out of the mine warehouse and sent below.

Workmen can be educated to economy in the use of supplies. The common waste of oil by motormen is unnecessary. Miners often break or lose their tools when they do not like them, or when they want new ones, but if they have to return the old tools to get new, or else be charged for the new, the management will be pretty sure of getting maximum length of service from all tools issued.

Prompt return of dull tools to the blacksmith shop for resharpening is another practice that makes for efficiency. Where two shifts are worked, it is a common thing for one shift to leave its dull tools for the next shift, rather than to take them out.

Discretion in the choice of supplies is important; many joints are made with high-priced sheet packing when cheaper packing would serve the same purpose, or even asbestos roll-board or mill-board costing about one-quarter as much. Or take the common spike used for a 30-lb. rail, the size is either 3½x½ in., or 4x½ in.; the cost, including freight from the wholesale house to the mine, will be approximately one cent per spike. The 3½-in. spike runs about 140 more to the 200-lb. keg than does the 4-in. There are places where a 3½-in. rail spike can be used instead of a 4-in. resulting in a possible saving of $1.40 per keg. Rail spikes are an excellent illustration, because so many are wasted in almost every mine, and in most mines are not recovered for use a second time, yet every 4x½-in. spike saved represents a saving of approximately one cent.

While none of these suggestions are new, they are worth calling attention to as ways in which efficiency can be increased in mining, with a resultant increase in production or a decrease in costs.

Mining Costs, Montana-Tonopah

The following figures give the cost of mining and development at the Montana-Tonopah, Tonopah, Nev., as shown in its report for year ended Aug. 31, 1913. Hoisting operations consisted of raising 69,188 tons of rock, of which 52,361 tons was ore. Development work totaled 10,243 ft. as shown in the table that follows:

	Average Cost per Ton of Ore	
	Mining	Development
Breaking:		
Labor	$0.440	$0.333
Supplies	0.197	0.213
Compressed air	0.086	0.062
Total breaking	$0.723	$0.608
Hoisting and dumping:		
Labor	0.207	0.086
Supplies	0.047	0.020
Compressed air	0.106	0.042
Total hoisting and dumping	$0.360	$0.148
General:		
Tramming and shoveling	0.794	0.315
Timber labor	0.243	0.062
Timber supplies	0.216	0.032
Supervision	0.090	0.064
Tool sharpening	0.025	0.022
Surveying	0.024	0.018
Sampling and assaying	0.038	0.016
Storekeeper	0.010	0.007
Water	0.004	0.013
Boilers	0.022	0.010
Mine machines	0.020	0.025
General expenses	0.051	0.034
Total	$2.620	$1.364

Development per foot:

Drifting	3166 ft.@$5.29 per ft.
Crosscutting	5578 ft.@ 4.42 per ft.
Raising	1335 ft.@ 4.26 per ft.
Sinking	164 ft.@16.29 per ft.

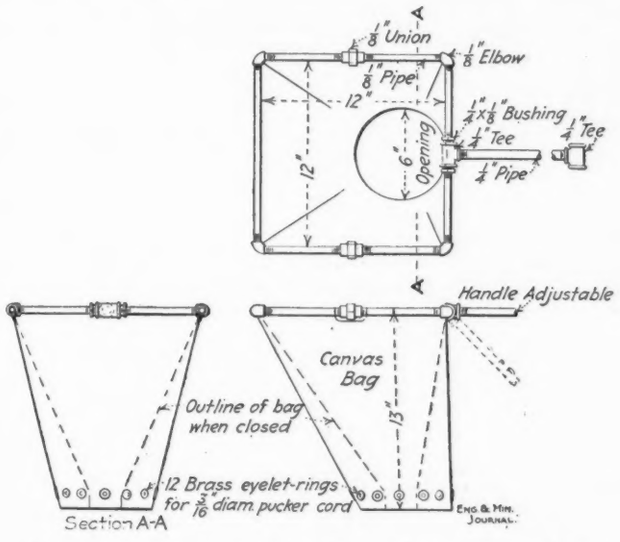
Total development, 10,243 ft. @ -4.86 per ft., exclusive of compressed air, hoisting and general charges.

Details of Practical Mining

Knock-Down Sample Catcher

By Edwin J. Collins*

It is sometimes difficult to get a suitable receptacle in which to catch samples cut from an ore face. A box is hard to hold in the desired position, especially in small workings. A canvas on the floor in many places is difficult to spread and where the ground is loose, material will sometimes fall on the canvas from outside the sample cut. Various sample catchers made of cloth on metal frames have been devised. The catcher here illustrated is one I designed and have found satisfactory. It consists of a frame, a handle and a canvas bag sewed to the frame. The frame is made of ⅛-in. wrought-iron pipe in two parts joined together by two unions. Into a ¼-in. tee



Canvas Catcher with a Frame of Small Pipe

bushed into one side of the frame is screwed a handle of ¼-in. wrought-iron pipe, which can be any length desired and can be set in any position in plane *PP* by turning the ¼-in. tee. A convenient length of handle for ordinary sampling is 2 ft. For ease of carrying in baggage, the handle can be made of a number of pieces of pipe, 12 in. long, screwed together with couplings when in use. A ¼-in. tee at the end of the handle gives a firm grip for the hand and makes the catcher easier to hold.

A canvas bag is suspended from the frame by being sewed to it. Openings are left at the two unions so that they can be screwed together and unscrewed. The bag is made to slope toward the handle side of the frame, as shown, bringing the center of gravity of the loaded bag as close to the handle as possible. The 6-in. opening at the bottom of the sack is closed by means of a pucker cord which is laced through the 12 eyelet rings shown in the drawing.

*Mining engineer, Torrey Bldg., Duluth, Minn.

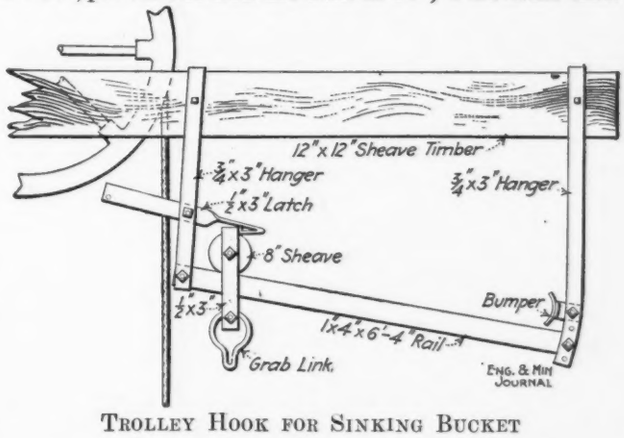
The canvas bag and frame will lie flat and are better than a piece of canvas when taking a sample close to the bottom of a drift. When taking large samples, the canvas bag can be emptied into the sample sack as many times as necessary. The sample will drop through the 6-in. opening into the sample sack or other receptacle, by untying the pucker cord. By the use of the handle, which can be set at any angle, the man holding the catcher can always stand so as not to interfere with the man cutting the sample. Thus, when the man cutting the sample is standing on a small, temporary platform, the man holding the catcher can stand below out of his way.

By means of the two unions, the frame can be taken apart and one-half folded over on the other half, so as to make a compact bundle taking up little space in the engineer's baggage. A pipe wrench is not necessary after the frame is put together and the canvas bag sewed on, as the unions and the handle can be made sufficiently tight by hand.

Dumping Arrangement in Sinking

By L. D. Davenport*

The accompanying drawing shows an arrangement for carrying a sinking bucket clear of the shaft. Two hangers of ¾x3-in. flat iron are bent at 90°, 6 in. from their



Trolley Hook for Sinking Bucket

upper ends and are fastened by ½-in. bolts to one of the 12x12-in. timbers under the sheave wheel. The hangers support a 1x4-in. rail, the upper corners of which are slightly chamfered to lessen the wear on the 8-in. sheave which travels over it. There are three bolt-holes in the lower end of the hangers spaced 3 in. so that the inclination of the rail may be changed; at present, it slopes 2¼ in. to the foot. A "grab link" is suspended from the 8-in. sheave by a yoke of ½x3-in. flat iron, and a short piece of chain with a hook at its lower end is caught into the grab link.

*Asst. chief engineer, Oliver Iron Mining Co., Hibbing, Minn.

A latch made of ½x3-in. stock, bent as shown, is fastened by a ¾-in. bolt to the hanger near the hoisting rope. A bumper curved to fit the sheave is fastened to the other hanger by a short L-shaped bracket.

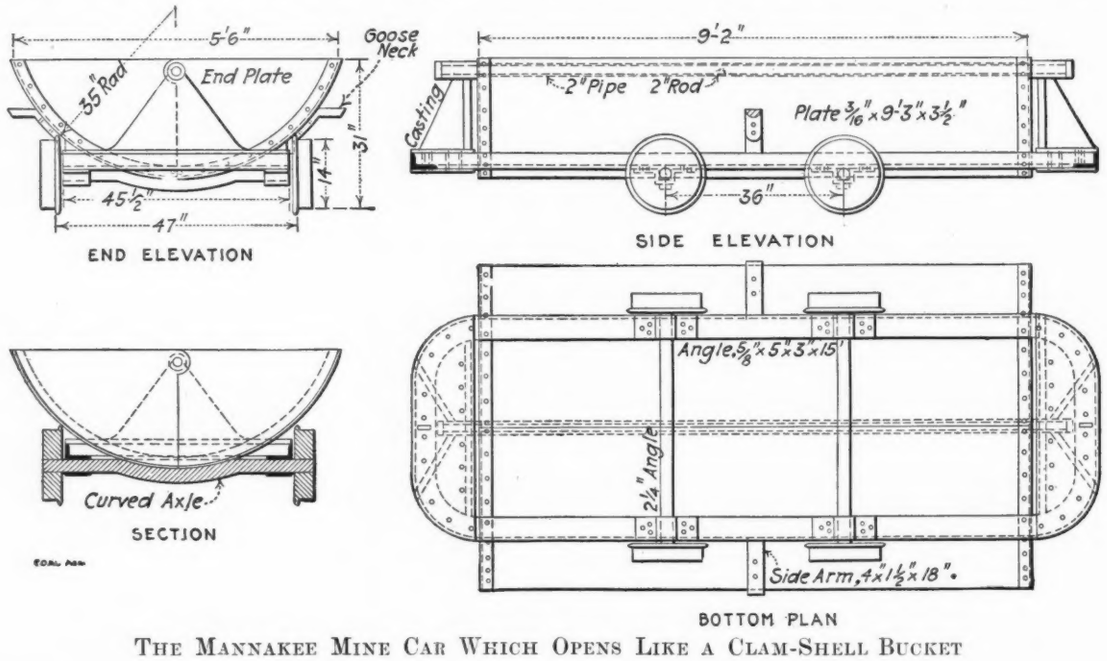
In operation the bucket is hoisted until the hook on the chain from the grab link can be caught into the bail. The bucket is then lowered, the latch released and the small sheave carrying the bucket rolls down to the bumper. This movement carries the bucket clear of the shaft and directly over a small car on the surface. The bucket is dumped, the hoist started and the traveling sheave returned to its original position, where it is held by the latch. The chain is then unhooked and the bucket lowered into the shaft.

Car with Semi-Cylindrical Split Bottom

An ingenious, and, we believe, unique type of mine car is described in *Coal Age,* Apr. 11, 1913. The car was designed by N. H. Mannakee.

The car body is round on the bottom, being somewhat less than a half cylinder. It is split longitudinally down the center and the two halves are supported in bearings carried on vertical castings at the ends of the car bed. The axles are fixed and are curved down somewhat at the center, so as to form a support for the movable halves of the body. Projections on the sides, called goosenecks, serve the purpose of opening the car for discharge and of closing it again. They are caught by curved guide bars on the side of the track and forced up so that the halves spread apart and remain so for a sufficient distance to allow the contents to run out, when the guides curve down and bring the halves together again. The opening must be at least sufficient to let the largest lump of material pass through.

The car is evidently low set and strong, easily loaded when shoveling is necessary, and easily dumped, this last operation requiring no uncoupling of the train. The bill of material appended gives dimensions additional to those of the drawing as well as the weight and capacity.



THE MANNAKEE MINE CAR WHICH OPENS LIKE A CLAM-SHELL BUCKET

BILL OF MATERIAL OF MANNAKEE CAR

Pieces	Size	Weight	Description
2	2¼" sq. x 57"	166	Axles
4	14" diam.	372	Wheels
4	⅜" x 16" x 5"	18	Boxes
2	⅜" x 5" x 1⅛"	473	Frame angles
2	Castings	400	End supports
2	⅜" x 48" x 13"	125	Bottom bumper plate
4	⅜" x 42" x 2¼" x 2¼"	82.6	Angles at ends
2	4" x 1½" x 18"	120	Side arms
1	2" x 126"	112	Round shaft
1	2" x 120"	30	Pipe
4	¼" x 4 sq.ft. x 7.65	125	Sheet steel ends.
2	35" x 9.25 x 7.65	500	Sheet steel side
72	½"	2	Rivets
65		10	Bolts
		40	
	Total	2 9.8	

Capacity of the car level full 77 cu.ft.

Two-Story Change House at the Homestake

BY B. C. YATES*

The Homestake Mining Co., of Lead, S. D., has recently completed and put into service a change house for underground men, which presents some new features in construction and equipment that may be of interest to the mining profession.

The building is situated near the Ellison hoist, the largest now operated by the company, and is designed to accommodate about 600 men, although at present used by only 524 men.

The walls are of hollow concrete blocks in two courses, giving a total thickness of 16½ in. The ground floor is of plain concrete laid on a broken-stone base, and the second floor is of reinforced concrete, supported on I-beams, the beams covered on the under side to protect them from rust, as well as from any fire that might occur in the clothing. The roof is of steel covered with Carey's patented cement roofing, laid on 1½-in. sheathing. There is no ceiling under the roof trusses. Three 30-in. Globe ventilators along the ridge of the roof assist in carrying

*Assistant chief engineer, Homestake Min. Co., Lead, S. D.

off foul air and lessen the smell which is always present where many damp working clothes are kept.

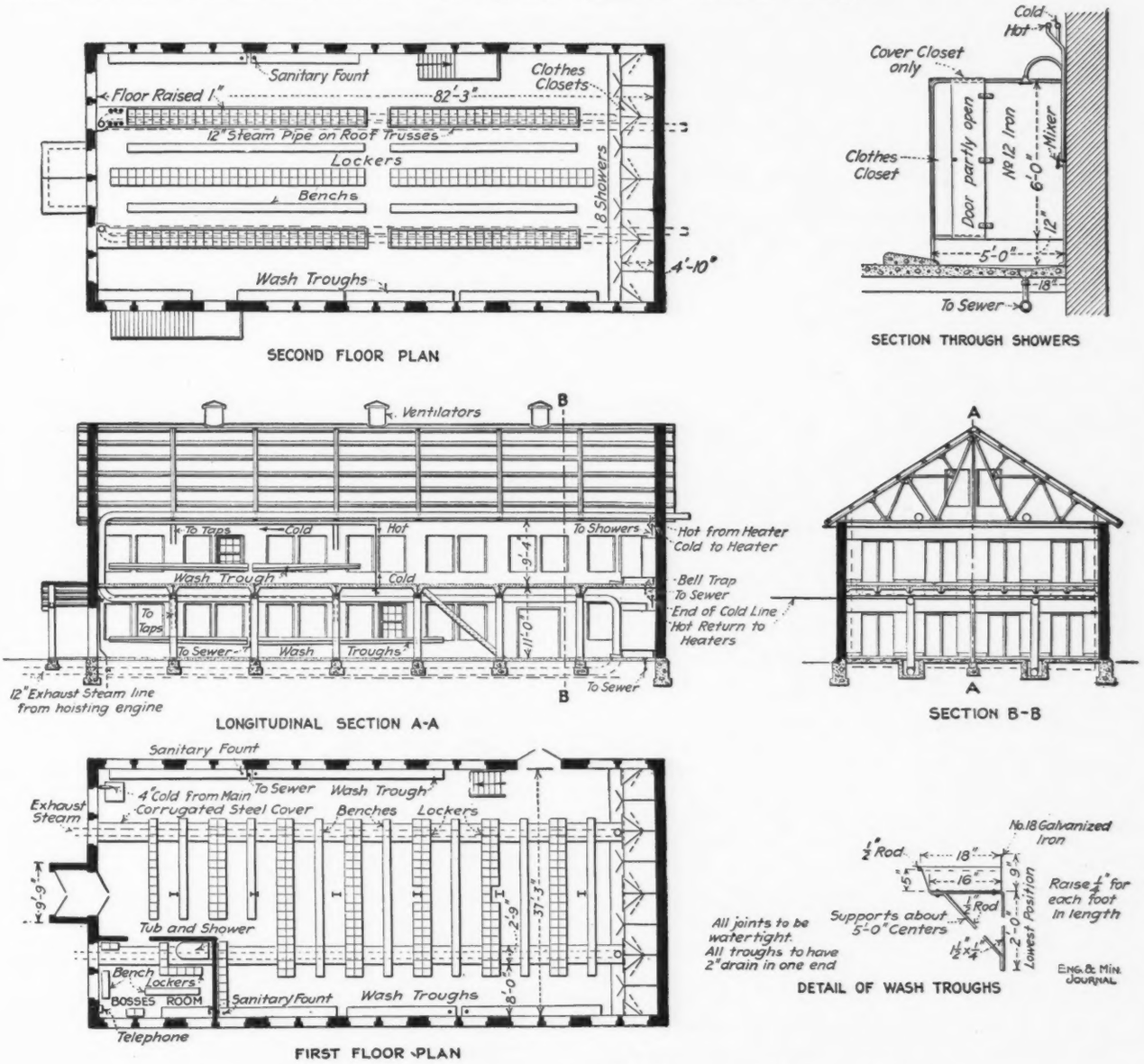
The window-glass area is about 17% of the entire wall area and is distributed in such a way as to give efficient lighting except in the end in which the showers are located. Here the building wall forms part of a retaining wall, built against the natural rock bank at the end of the excavation.

The building is heated by exhaust steam from the hoisting engine, the steam being carried to the rear end of the building in two 12-in. pipes laid under the ground floor in conduits covered with steel plates. Here the pipes are turned and carried up to the under side of the second-floor beams, returned to the front end of the building, passed up through the second floor to the bottom chord of the roof trusses and finally returned to the rear end and passed out through the wall.

Water for wash basins and showers is heated by steam in a large tank heater in the hoist building nearby.

There are 16 shower stalls with partitions made of galvanized iron supported on a framework of angle iron. A patented mixing valve called the Niedecken Mixer, made by the Hoffmann & Billings Mfg. Co., Milwaukee, Wis., is used to control the supply of hot and cold water to the showers.

The lockers are all steel, 15x15x72 in., with perforated doors, a top shelf for hats and small articles, and hooks under this shelf for clothes, the bottom serving as a shelf for boots. Each man is allotted one locker and furnishes his own lock and key.



PLANS, SECTIONS AND DETAILS OF THE NEW HOMESTAKE CHANGE HOUSE

The galvanized-iron wash-troughs are set along the walls under the windows and hot- and cold-water faucets are spaced about 24 in. along the trough. Each man is supplied with a wash basin, which he keeps in his own locker. A room in one corner of the first floor is used by the shift bosses. In this room are lockers, a bath-tub and shower, a wash trough, a desk and a telephone. This room offers opportunity for the bosses to talk over their work privately and permits their being reached by telephone before going down into the mine.

Separate Conical Drums for Counterbalance

At the Curry shaft of the Penn company at Vulcan, Mich., the arrangement for driving and counterbalancing the hoisting drums is that shown in Fig. 1 (*Bull.* A. I. M. E., February, 1914). The cylindrical hoisting drums are of cast iron, and are 12 ft. in diameter with 6-ft. face. The drum shaft is driven through Falk cut helical gearing, the gear ratio being 9.52 to 1. The pinion shaft

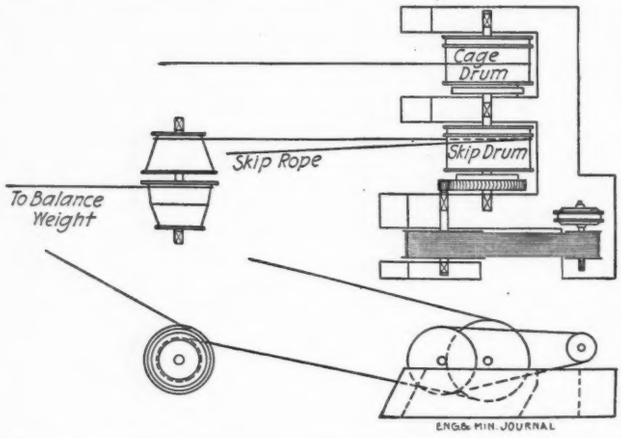


FIG. 1. ARRANGEMENT OF CURRY HOIST AND BALANCE DRUMS

also carries a rope wheel, 9 ft. 10 in. in diameter, with 24 V-grooves for 1¼-in. manila rope. In order to give this rope wheel sufficient flywheel effect, the rim is made 3⅛ in. thick. The wheel is driven by a 350-hp. motor by a 50-in. rope pulley. The skip load is 12,000 lb.; the maximum travel of the skip, 1410 ft., the skip speed, 600 ft. per minute.

In order to equalize the weight of the skip, a counterbalance is run in the shaft, and in order to equalize the

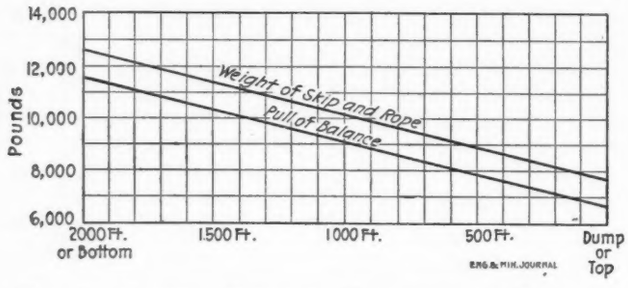


FIG. 2. CURVES, SHOWING VARIATION IN BALANCE

weight of the rope, the counterbalance rope is wound on a conical drum. A change in the angle in the middle of this drum makes the counterbalancing closely approach theoretical correctness. This drum is set outside the hoist house altogether, between it and the shaft. Another conical drum is mounted on the same shaft with it and is driven by a rope from the skip drum, as shown.

This set of two drums permits a cheaper installation than if one conical drum with a much greater difference of diameters be direct connected to the hoisting-drum shaft. Not only do the drums cost less, but the hoist house may be made smaller and hence cheaper.

In Fig. 2 is shown the variation in balance between the skip and the counterweight. It will be noticed that the two curves are parallel, showing that the slope of the conical drums is substantially correct. The hoisting rope weighs 4900 lb., the skip, 7600 lb., the counterbalance, 8260 lb. The difference in weight is necessary to permit the skip to run down and pull up the counterweight without the application of power.

The results of a test on this hoist are shown in the table. From this, it appears that it takes 2.1156 kw.-hr. to hoist a ton 1500 ft., and this costs 0.712c. On a re-

RESULTS OF TEST ON CURRY ELECTRIC HOIST

Date June, 1912	Kilowatt-Hours Integrating Meter	Number of Tons 16th Level	From 17th Level	Live Ton-Feet	Kilowatt-Hours per Live Ton-Foot
12	243.75	117	12	169,956	0.001434
13	462.5	210	36	325,440	0.001421
14	481.25	243	18	343,224	0.001402
17	450	258	3	341,694	0.001318
18	456.25	216	24	316,368	0.001442
19	462.5	228	21	327,834	0.001411
20	462.5	222	18	315,756	0.001465
	3,018.75			2,140,272	0.0014104

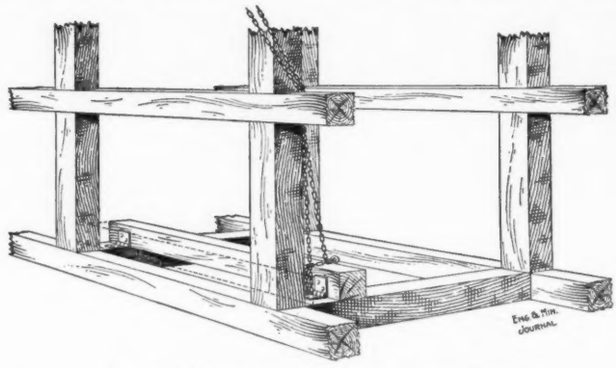
From 16th level, 1308 ft. to dump; 17th level, 1410 ft. Hoisting speed, 600 ft. per min. Load, 12,000 lb. of ore.

cent capacity test, 13 skips or 78 tons were raised 1410 ft. in 61 min., equivalent to 325,000 or 350,000 per year. From data collected in this test, it is estimated that with a hoisting speed of 1200 ft. per min., an output of 300,000 tons per year could be obtained from a depth of 3000 ft. The system is efficient, cheap in first cost and requires only a small building to house it.

Skip Dog for Inclined Shaft

BY WALTER R. HODGE*

The dog illustrated here is used in the London and Burra Burra shafts of the Tennessee Copper Co. Both these shafts dip at about 75°. The dog is a piece of oak



CHAIN-OPERATED, HINGED SKIP REST

8x8 in., stretching across the compartment and resting on and hinged to the dividers between the compartments below the shaft station. The hinges are strongly made of ½x2-in. strap iron. When not in use the dog lies back and out of the path of the skip, clearing it by about 3 in. Two chains encircle the dog and are fastened to an eyebolt through the timber. The free end of each chain reaches to the level above. When it is desired to use the dog, one of these chains is given a slight pull and the dog rolls over on its hinges and takes a position across the shaft in the path of the skip. To clear the shaft the other chain is pulled.

*Mining engineer, Ducktown, Tenn.

Details of Milling and Smelting

Mechanical Shops at Arizona Copper Co.'s Smelting Works

In the erection of large metallurgical works, the mechanical shops are an important factor in the maintenance of the plant. At the Arizona Copper Co.'s new smelting plant, two miles south of Clifton, the mechanical-shop equipment is of interest as it represents a typical installation for a works in a fairly isolated situation. As shown in the accompanying illustration, the shops are constructed of hollow tile and steel, and each building is equipped with Kinnear steel rolling doors, this construction extending to the warehouse as well as to the mechanical shops.

In the erection of the Arizona Copper Co.'s works, the mechanical shops were among the first buildings completed so that their facilities could be utilized in the con-

MECHANICAL SHOPS AT ARIZONA COPPER CO.'S NEW WORKS

struction of the plant. The equipment in the shops is as follows:

BOILER AND FORGE SHOPS

1 No. 2 Hilles & Jones punch and shears.
1 No. 0 Hilles & Jones bending rolls.
1 Acme 2-in. bolt-heading machine.
1 Bement 1100-lb. steam hammer.
1 Crocker-Wheeler 20-hp. motor.
1 Type D, size 5, American blower.
1 Fort Wayne 5-hp. blower motor.
1 five-ton Pawling & Harnischfeger hand-power traveling crane, with three-ton Yale & Towne triplex block.

MACHINE SHOP

1 No. 3 Q. & C. shop saw.
1 5x42-in. grindstone.
1 McCabe 48-26 in. by 28 ft. lathe.
1 Lodge & Shipley 14 in. by 8 ft. lathe.
1 Rockford 20-in. shaper.
1 American 42-in. radial drill press.
1 Acme bolt and nut threader.
1 E. C. & B. 12-in. pipe machine.
1 E. C. & B. 4-in. pipe machine.
1 E. C. & B. 2-in. pipe machine.
1 Crocker-Wheeler 40-hp. motor.
1 five-ton Pawling & Harnischfeger hand-power traveling crane, with five-ton Yale & Towne triplex block.

TIN SHOP

1 50-in. Hares cornice brake.
1 Lodge turning machine.
1 Peck, Stow & Wilcox burring machine.
1 Peck, Stow & Wilcox 36-in. squaring shears.
1 sledger.
1 crimper.

Ore Sampling and Weighing at the Nipissing Mill

Sampling of mill feed continues to be a vexed question among metallurgists; the merits of the bullion-plus-tailings method for arriving at the ore content, and the direct-sampling method, are still argued. An example of one mill where actual weighing and sampling are insisted upon will be of interest.

Th new low-grade mill of the Nipissing Mining Co., at Cobalt, Ontario, has facilities for accurately weighing and sampling every pound of ore that comes into it. Ore from the various mines of the company comes into a bin at the mill. From this bin it is drawn into cars which hold about 20 cu.ft. each. These cars are taken to a platform scale, where an operator balances the load and turns a screw which punches in a card both the gross weight and the tare, or car weight. The operator has nothing whatever to do with the actual figures of the weighing. He simply balances the scale and punches the card. The figures are recorded automatically. Moisture samples are taken from time to time so that its percentage is known. Thus the weight of ore going into the mill is accurately known and recorded.

At this mill, the ore is crushed in a caustic-soda solution, then automatically sampled before going to the desulphurizing process described by James Johnston.[1] Pulp is sampled by cutting the stream every six minutes as it comes into the collecting tanks. Since the solids in this pulp are all finer than 200-mesh, and there is no cyanide or other solvent in the solution, an accurate sample is assured. With the weights and samples thus secured, an exceedingly close estimation of the actual ore content is made, which is charged against the mill.

Weights secured by the scale method are checked against those made by specific-gravity estimations on the plant, but by reason of the varying specific gravity of the ores, which differ widely, this latter method is not entirely reliable. In one month the specific gravity may be 2.6, while in the next it may rise to 2.8. This shows the danger of using the specific-gravity method constantly, with an average calculated specific gravity of solids. Serious error might result under such circumstances.

Residue samples are taken from the filter tank at the time of its discharge. A number of cuts are made, and these are all mixed to make the total sample. It will be

[1]Mill and Metallurgical Practice of the Nipissing Mining Co., Ltd., Cobalt, Ontario, Canada. "Bull." A. I. M. E., Feb., 1914.

seen that through these careful weighings and samplings, an accurate knowledge of what is going in and out of the mill is obtained. The bullion production must check with the amount indicated by weighing and sampling, and there is no chance for an error of any kind to pass undetected.

At the high-grade mill of the company even more stringent methods are followed. The entire ore tonnage of this mill, averaging about 2500 oz. silver per ton, is sent to an outside sampling plant, where it is crushed, weighed and sampled by machinery especially adapted for such work. Ore then, delivered to the mill, must be accounted for in its entire silver content, either in bullion produced or in the tailings. In neither of these plants are estimations countenanced. Tonnages are actual weights by scale and contents are by actual assay, corrected by most careful methods, on actual samples, correctly taken.

Franz Concentrating Table

The concentrating tables shown in the accompanying illustrations was designed to secure a cleaner separation of ores of complex nature, higher extraction, and maximum capacity for a given table area.

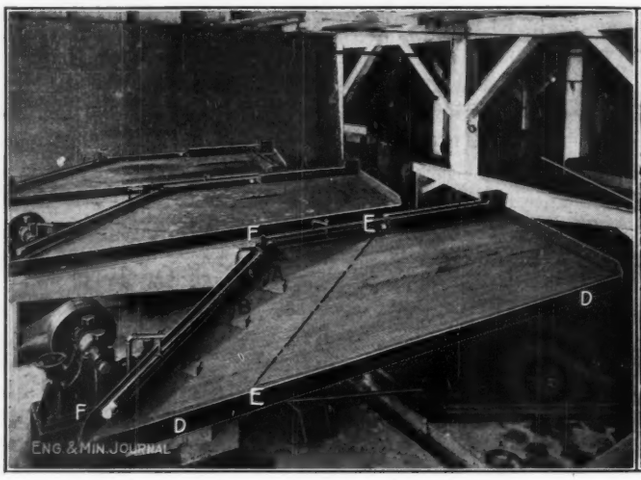


FIG. 1. FRANZ CONCENTRATING TABLE

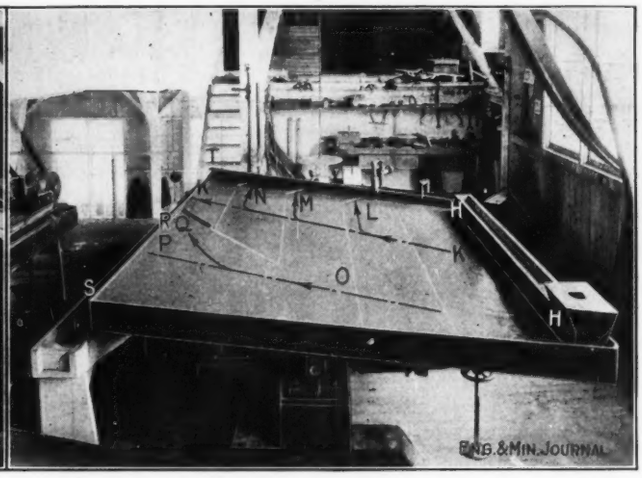


FIG. 2. FRANZ SLIME TABLE

Unless obstructed, heavier ores will naturally reach the discharge end of any table, first; in the case of the Franz table, however, the heads are discharged through slots *AA, BB* and *CC,* Fig. 1, through the deck, as soon as the separations are made, most of the high-grade ore being extracted through slot *AA*. The rest of the ore, under ordinary conditions, is discharged through slot *BB*. But if the material for separation contains lead and zinc ores, slot *CC* can be made to take either a low-grade lead or the zinc ore, or the zinc and lead middlings, leaving the zinc ore to pass over the side *DD*.

To make a table of this sort as efficient for its size as possible, the ore must not be rushed too quickly across the table by the feed water, but, on the contrary, must be given a chance to settle quickly in the grooves. It is desirable, therefore, to have a minimum tilt of the deck toward the side *DD*. A slight tilt of the deck, however, would cause too much sand or gangue to pass off with the ore. This difficulty has been overcome by the use of a "flexible deck," the term being derived from the joint or hinges along the line *EE,* which permits raising the edge *FF*.

The washing of the ore takes place on the "flexible" portion of the deck, which may be adjusted at will to regulate the quality of ore discharged through the different slots. A particularly interesting feature is the placing of the head motion at the discharge end of the table, where it is not subject to slop and grit from leaking feed spouts.

A decided novelty about the slime table, Fig. 2, is the discharge pan *Q,* which collects the finest ores from the finest slimes. The action of the slimer is as follows: The feed, 200 mesh and finer, enters at *HH*. The heavier slime passes in the direction *KK*, is washed, and the ore extracted through slots *L, M, N,* the same as on the sand table, the gangue passing over the edge *QT*. The lighter slime and ore, held in suspension, pass in the direction *OP,* being retarded in this distance and trapped against the riffle *RS*. The finest ore passes into the pan *Q* and is extracted through the deck, while the lighter slime passes over the riffle *RS*.

These concentrating tables are manufactured under United States and foreign patents by the Franz Concentrator Co. at Wallace, Idaho.

Safe Handling of Caustic Soda

Caustic soda used at the mill of the Nipissing Mining Co., Cobalt, Ontario, reaches the plant in metal drums, the contents of which are a solid mass of the chemical. Since caustic soda is dangerous to handle, it was considered impossible to allow these masses to be broken up by hand, as with such large quantities, injuries are almost sure to occur at some time. To avoid such a contingency, a small steel tank is provided. The metal drum containing the caustic soda is slit down the side and ends, the material rolled out in a solid lump, lifted with a chain block, and placed in the steel tank. Here it is left to dissolve in water forming a concentrated solution, which is piped to the point where it is to be used. In this way all danger of injury to workmen is avoided.

The caustic soda is used to make a solution for the desulphurizing process, used apart from the cyanide-solution circuit.

Company Reports

Mason Valley

The Mason Valley Mines Co., Thompson, Nev., in its report for 1913 states that 227,855 tons of ore were smelted, of which 116,636 tons were from the company's mine and 111,219 tons from custom ores. This ore produced 17,166 tons of matte containing 14,601,250 lb. of copper, 9922 oz. gold and 121,834 oz. silver. The profit and loss statement shows a profit of $205,904 for the year and a balance of $120,564 carried to surplus account, after charging off interest paid on bonds and debts. Before going into other parts of the report, an analysis of the financial statements made by a comparison of the 1912 and 1913 annual reports may be of interest.

At the end of 1912, including prepaid insurance, taxes, and $78,464 carried on the books as a suspense account due from various mining companies, the balance of quick assets amounted to $222,490, and at the end of 1913, including prepaid taxes and insurance, the balance was $250,586. This gives a net gain of $28,096.31, and as no dividends were paid, represents the actual gain applicable to dividends. Using figures obtained by comparing statements of 1912 and 1913, this figure is checked in the following manner:

Operating receipts from sale of products		$2,809,920
Operating receipts from rents		5,037
Total operating receipts		$2,814,957
Expenditures:		
Operation charges, less cost of unsold metals	$2,526,644	
Selling expenses, etc.	82,408	
Net increase in mining lands accounts	$11,532.28	
Net increase in plant accounts	168,900.51	
	$180,432.79	
Less decrease in deferred charges	131,201.38	
Net expenditures on charges to capital accounts	49,232	
Total net expenditure for operations and plants		2,657,284
Net balance over all expenditures during year, exclusive of bond and debt interest		$157,673
Bond and interest transactions:		
Decrease in bonds outstanding	$48,500	
Interest paid on bonds and debts	85,340	
Total	$133,840	
Less receipts from capital stock	$1,000	
Decrease in sinking fund	13,133	
Premium on bonds	3,130	
Total	$17,263	
Net expenditure for bonds and interest		116,577
Balance		$40,096
Less investment in Government land script		12,000
Actual net gain in quick assets		$28,096

The combined smelting capacity since the enlargement of two blast furnaces is 1800 tons of ore per day. The smelter product has been a copper matte containing approximately 40% copper. A converter plant has been added and started operations on Jan. 3, 1914. Custom-ore shipments to the smeltery have been materially reduced and the report states that the future of the company depends largely upon developments in the company's own mines and properties under option. If sufficient tonnage can be produced to permit the smeltery to operate at full capacity profits are expected to increase. No mention is made of the probable amount of ore in reserve.

Nipissing

In its report for 1913 the Nipissing Mining Co., Cobalt, Can., shows a net profit of $1,645,107 arrived at in the following manner: Gross value of ore production, after deducting ores purchased, $2,756,612; other receipts, $47,481; making total receipts $2,804,093. The cost of mining and all other expenses, including smelter deductions, treatment, etc., on settlements of 1913 ore and accrued charges on ore and bullion at mine and in transit was $1,143,822. Special investigations caused an outlay of $15,164. Dividends aggregated $1,830,000 and after payment of this amount a balance of $718,558 remained in quick assets. All the dividends were paid by the Canadian corporation to the holding company, the Nipissing Mines Co., New York. The expenses of this corporation were $31,757 in addition to those given for operations and the dividends distributed by it to the stockholders amounted to $1,800,000. To date, the company has produced 32,585,417 gross oz. of silver, having a gross value of $18,778,955, including price received for cobalt, nickel and arsenic contents. The net price received by the company for these products was $17,569,166. Dividends to date by the Nipissing Mines Co. total $11,340,000. Ore reserves are estimated to contain 214,644 tons of ore containing 9,510,014 oz. of silver. Of this tonnage, 2464 tons average 1897 oz. of silver per ton and the remainder is mill ore averaging 22.8 oz. of silver.

The production for 1913 amounted to 4,552,172 oz. of silver and all shipments totaled 6,648,046 oz. Of this, 1,803,877 oz. came from purchased ores. The average price received was 60.261c. per oz. Based upon the production of 4,552,172 oz., the cost was 24.09c. per oz. compared with 17.39c. in 1912. This increase in cost is due to the fact that while the production of silver for both years is practically the same, in 1912 nearly all came from high-grade ores, while in 1913 about half came from low-grade milling ore. It is stated that from now on the production of high-grade ore will be limited to the capacity of the picking plant which also handles all ore that goes to the low-grade mill. Picking is now done at one central plant, while heretofore a number of small plants were situated at the principal shafts.

The high-grade mill treated 1200 tons of company ore and 632 tons of custom ore. The precipitates from the low-grade mill also are melted and refined at this plant. The residue of the high-grade mill carries from 20% to 40% silver, 8% to 10% cobalt, 4% to 6% nickel and 30% to 40% arsenic; 1659 tons of this product was sold and netted $62,484. By applying principles used in the reduction of low-grade ores it is hoped that a process will be worked out for high-grade ores whereby they can be

treated by cyanide only. In the treatment of low-grade ores, the actual recovery has averaged 91.85%. The following table gives interesting data on the cost of treating 77,240 tons of ore, averaging 27.2 oz. silver, at the low-grade mill:

TREATMENT DATA AND COSTS—LOW-GRADE MILL

	Lb. per Ton	Cost per Lb.	Total Cost per Ton Ore
Supply consumption:			
Cyanide	5.190	$0.1500	$0.7785
Caustic soda	3.2000	0.0214	0.0684
Lime	6.640	0.0040	0.0266
Aluminum dust	0.568	0.3373	0.1917
Aluminum plates	0.268	0.2438	0.0654
Aluminum ingots	0.964	0.2207	0.2128
Flint pebbles	6.540	0.0098	0.0646
Ore pebbles	3.100	.....	.....
Coal for reheating	30.160	0.0029	0.0881
Power, kilowatt-hours	51.570	0.0115	0.5933
Total			$2.0894

Costs:	Per Ton
Crushing at mine	$0.163
Aërial tramway	0.100
Surface tramway	0.117
Picking plant	0.217
Crushing	0.081
Battery	0.267
Tube mills and classifiers	0.547
Slime collecting	0.448
Intermediate filtering	0.127
Treatment	1.021
Filtering and discharging	0.186
Clarifying and precipitation	0.301
Refining	0.127
Heating	0.113
Water supply	0.031
Construction	0.286
Total milling cost	$4.132

Tennessee Copper

The 1913 report of the Tennessee Copper Co., Copperhill, Tenn., shows a total production of 17,797,338 lb. of copper, of which 4,257,822 lb. were from custom ores; this would make the production from company ores 13,539,516 lb. However, a recapitulation of operations shows that 483,926 tons of ore were mined, 470,135 tons smelted and 13,493,140 lb. of copper produced. Dividends aggregating $750,000 were paid; it is stated that only $450,000 of this amount was paid out of 1913 earnings and the balance $300,000 came from surplus carried forward from 1912, although this is only a matter of accounting entries, as will be seen below. The sulphuric-acid plant produced 197,713 tons of acid, all of which was taken by the International Agricultural Corporation. The contract with this concern has been modified so that in the future the Tennessee Copper Co. may sell for its own account any acid produced in excess of the demands of the International Agricultural Corporation.

The company has reduced its bonded indebtedness by $200,000, spent $16,646 on new development, which it charged to assets and increased its plant account by $132,420. From the sale of copper and acid the company received an income of $1,158,530 after deducting operating charges. After payment of interest on first mortgage bonds amounting to $71,000 and depreciation and income taxes amounting to $120,000 the net profit indicated for the year was $966,703. Dividends totaling $450,000 were paid out of this profits, leaving $516,703 to be added to surplus account. In 1913 all inventories are figured at the cost of production instead of at market price as in previous years. Surplus account at the beginning of the year was $2,084,303, and in adjusting the books on the basis of new inventories, $341,194 was written off copper and acid inventories, $540,000 from copper in process, and other items including $300,000 in dividends were written off, making total deductions from surplus at Dec. 31, 1912, $737,018. The inventory value placed on copper at refinery in current report was 11.24c. per lb.; copper in pig and in transit to refinery, 10.21c. per lb., and copper in process at smeltery, 9.72c. per lb. The operating costs at the property amounted to $2.93466 per ton of ore as follows:

	Per Ton Ore
Mine development	$0.11827
Mining	1.01933
Railway expense	0.07377
General expense	0.19263
Smelting	1.38745
Converting	0.14321
Total	$2.93466
Cost per pound of copper	10.214c.

MATERIAL TREATED AT SMELTERY

	Tons	Per Cent. of Total
Tennessee Co. sulphide ore	455,800	56.4
Custom ore, El Cobre	10,455	1.29
Converter slag	13,042	1.61
Blast-furnace slag	26,846	3.32
Sinter*	43,996	5.45
Quartz	79,698	9.86
Limestone	39,301	4.86
Matte	97,286	12.00
Coke used	42,152	5.21
Total	808,566	100.00

*14,335 tons of Tennessee ore included in this figure was used as bond.

It is stated that experience has shown that it is more profitable for the company to smelt its own ores, so that the additional equipment to be installed in the smeltery will enable the company to maintain a maximum production of copper without purchasing ore from other properties. Work at the blast furnaces has improved so that results intended to be accomplished by the bedding plant are now accomplished without bedding. Bids are now being secured on the following new construction; new steel shaft house for the Burra shaft, new steel shaft house for the McPherson shaft, hoisting engines and air compressors for the Burra mine, enlarging Nos. 1 and 2 matte furnaces. Some extensions to acid plant are under way to permit a larger production.

The ore reserves are estimated to contain 5,534,984 tons in sight that will yield about 28.70 lb. of copper per ton. Judging from the cost of producing copper and the price received by the company, profits from the production of sulphuric acid were in the neighborhood of $363,000, or about $1.83 per ton of acid produced.

Contact Copper Co.

The 1913 report of the Contact Copper Co., Houghton, Mich., says that owing to conditions brought on by the strike the company has been unable to make a sale of its timber and as a consequence all diamond-drill work was suspended on Aug. 2, 1913. However, as soon as the treasury has sufficient funds work will be resumed again. The company started the year with $17,886 in cash, accounts, and supplies; received $3983 from the sale of timber, etc.; and ended the year with a balance of $1474 in quick assets. A total of 3655 ft. of rock formation was drilled in four holes. Holes Nos. 13 to 16 make up one section through the Winona lode and the Shawmut lode and the intervening territory, a belt 3000 ft. in horizontal width, within which the drilling disclosed six copper-bearing beds, the copper in all these beds was widely disseminated.

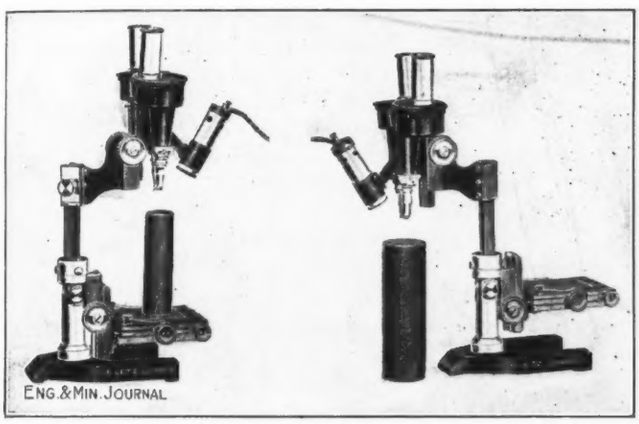
El Oro Mining & Railway Co., Ltd., reports that on Apr. 26 all surface operations were suspended, and all American employees withdrawn. About May 18, all English employees were withdrawn also, and the Mexican employees left in charge. Because of disturbed conditions in Mexico the half-yearly dividend has been passed.

Mining & Metallurgical Machinery

A New Microscope for Metallurgical Work

Metallurgical microscopes differ considerably from those used for biological and mineralogical research, principally from the fact that the metallurgist is solely concerned with opaque specimens.

Considerable advance has recently been made in the microscopy of metals and it has been found necessary to use an auxiliary microscope for the closer examination of metallic specimens other than those having polished or etched surfaces involving careful preliminary preparation. Greater attention is now given to the examination of the fractures of test bars and also to fractures resulting from the failure of metals under working conditions.



BINOCULAR MICROSCOPE FOR EXAMINING OPAQUE SPECIMENS

To meet this need a complete and substantially built binocular microscope, giving an erect and truly stereoscopic image and possessing many desirable features, has been constructed to the specification and design of Wesley Lambert, the late chief metallurgist of the Royal Gun Factory at Woolwich, England, by Messrs. E. Leitz, of London. The two objectives are on a single slide, the lenses being carefully paired, and provision is made to allow for a separate focusing for each eye. Provision is also made for adjusting the oculars to the correct width between the pupils of the observer's eyes.

The stand consists of a heavy horseshoe base of large dimensions, which carries a substantial pillar to which the stage and body are fitted. The latter is considerably overhung and is secured by a hinged joint, allowing the tilting of the instrument through an angle of 90°. The upper portion of the instrument may be detached and reversed by means of a simple slide joint, locked by a single milled screw head; in this way it is possible to examine bulky specimens too heavy to be carried on the stage or of such size that the microscope must be mounted above or placed upon them. Independent rack-and-pinion movements are provided for the microscope and the stage.

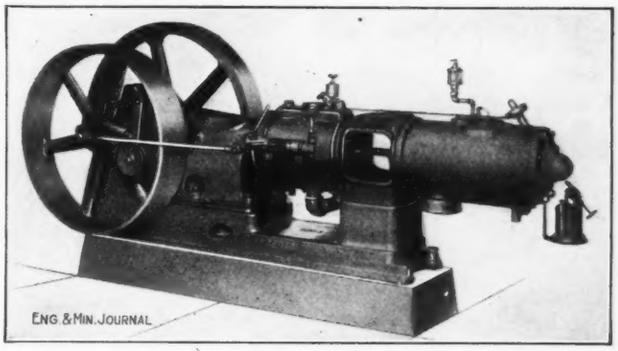
Direct-Connected Oil-Engine-Driven Compressor

The increased use of low-grade oil fuel for power purposes has led to the design, by the Ingersoll-Rand Co., of the oil-engine-driven air compressor illustrated herewith.

This is of the straight-line type and somewhat resembles in this respect, as well as in the design of the air end, the company's standard line of small compressors. The main frame is designed for a splash system of lubrication; it is of the wholly inclosed type and provided with removable covers.

The feature of greatest interest is the driving end. This consists of a single cylinder set behind the air cylinder and direct connected to the air piston. It follows in general design, a type known as the hot-bulb engine, and combines a high thermal efficiency with great simplicity of construction and little complication in details of design, there being an entire absence of auxiliary air compressors, etc., as well as a lower working pressure.

The cylinder is of the single-acting, two-cycle type, water-jacketed and provided with an efficient system of



STRAIGHT-LINE, 66-CU.FT. COMPRESSOR, DRIVEN BY OIL ENGINE

lubrication. It is fitted with a torch for heating the ignition bulb preliminary to starting. After the compressor is under way this torch is dispensed with.

The fuel is automatically injected into the combustion chamber, by means of a small pump on the side of the frame, operated by the main shaft. It enters in the form of a finely atomized spray and is immediately ignited by the hot bulb, dispensing entirely with electric sparking devices, batteries, etc. The stroke of the fuel pump is regulated by a centrifugal governor located in the flywheel; thus regulating the amount of fuel injected into the cylinder in proportion to the load. This is supplemented by a regulating device of standard design, on the intake to the air cylinder.

The operation of this machine is accompanied by none of the losses pertaining to the common two-cycle gasoline engine, in which part of the incoming charge follows the exhaust gases through the outlet ports and is wasted. This is due to the fact that the fuel is not vaporized by

an outside agency and introduced with the air used for scavenging, but is injected directly into the cylinder, at the end of the compression stroke. Hence, pure air is used during the scavenging period of the stroke, and the inlet and outlet ports can be so arranged that more thorough scavenging is afforded without any loss of fuel. The absence of carburetor, with its needle valves, springs and delicate adjustments which have to be constantly changed to suit atmospheric conditions, is an advantage which cannot be overestimated.

A feature of this engine is the introduction of a small quantity of the water from the cylinder jacket into the combustion space. This water performs the function of regulating the temperature in the cylinder, thereby preventing an undue rise in temperature and dissociation of the fuel. It reduces the maximum pressure in the cylinder, while slightly increasing the mean effective pressure, making a smooth running and highly economical machine. The amount of water injection is regulated according to the load on the compressor.

The compressor is at present made in but one size, with an actual capacity when running at 325 r.p.m., of 66 cu.ft. of free air per min. compressed to 100 lb., or 73 cu.ft. compressed to 80 lb. The fuel consumption at this speed, and under average operating conditions is about 2.2 gal. of kerosene per hour. It is adapted to run on either kerosene, fuel oil or distillate. Its weight complete is 3000 lb. and the floor space occupied is 8 ft. 10 in. by 2 ft. 5 in.

New Acetylene Mine Lamps

A new line of acetylene lamps suitable for use in metal mines, has been put out by the Justrite Mfg. Co., of Chicago. One of these, No. 91, is similar to the old No. 90, but will burn a little longer, namely, 4½ hours. The reflector is made somewhat larger than in the No. 90, being 2½ in. in diameter.

Another new model, No. 93, called the "Anaconda Special," is of similar design, but will burn still longer, 5 hr., using 3½ oz. of carbide. It is slightly larger and is made of heavier brass. A new feed arrangement permits the carbide container to have straight sides without threads, a desirable feature, as rendering it easier to clean the container. The device consists of a brass post riveted to the center of the carbide-container bottom and screwing into a brass socket in the water reservoir; the water tube slips over the post and feeds water automatically to the bottom of the carbide container. The candlestick for this model is of ¼-in. steel, 11 in. long with a square, sharpened, tempered point.

The "Jumbo" model, No. 50, involves several new features. It is much stronger and larger, designed to resist the effect of severe falls. It is unusual in being molded of ⅛-in. seamless aluminum and in the arrangement of candlestick and suspension hook. The swivel attachment of the hook permits hanging the lamp in almost any position. The candlestick is easily snapped into the bail of the suspension hook. The feed for this model is similar to that of No. 93. The bottom of the carbide container is flared slightly to permit its sitting flat and firm. A burner tip of solid aluminum, which will not break, is provided. The lamp will burn 6 hr., and weighs 1½ lb.

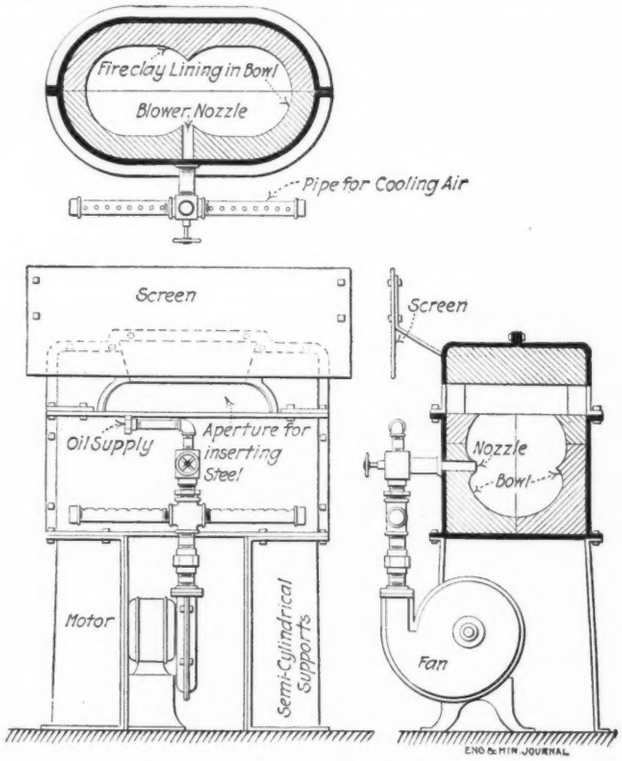
The Justrite Co. makes two other lamps of possible value in metal mining, namely a lantern, No. 70, and a headlight, No. 44, which would seem to deserve investigation by any company having a mind to safety around the powder magazine.

The lantern uses a fish-tail burner and is rated at 20 cp. The headlight is made similar to the familar electric cap-lamp, the generator being carried at the belt and the burner in the cap, with a fabric-covered rubber tube for connection. A special, ground lens for longer projection of the light, is furnished for 50c. extra.

Low-Pressure Oil Forge

An oil-burning forge for heating drill steel, the distinctive feature of which is the fact that the oil is atomized by air under low pressure, is put on the market by the Denver Fire Clay Co.

The forge consists of a fireclay-lined bowl, supported on two semi-cylindrical iron legs, between which the blowing apparatus is situated. The drills are inserted for



Oil-Burning Forge with Fan Blower

heating above the bowl. The air supply is furnished at a 6-oz. pressure by a motor-driven fan. The oil and air from the nozzle impinge on a point in the lining and are deflected to give a swirling motion, resulting in complete combustion, long duration in the bowl, and a high heat. A horizontal pipe along the front of the forge contains a series of holes on its top through which the air from the blower passes and makes a screen of cool air protecting the operator; a screen is also attached to the top of the forge by brackets.

As compared with a coke or coal forge, the oil fuel offers the advantage of adding no sulphur to the steel and of allowing the drill bits to be under observation at all times. The low pressure and the provisions for complete combustion eliminate noise and smoke. It is also

claimed that a considerable saving in power over high-pressure air blowing is obtained, that the oil can be safely conducted to the forge by gravity and that there is small likelihood of oxidizing the steel so that it scales.

Filtros--A Filtering Tile*

The development of a new mineral filtering medium, called Filtros, bids fair to bring about many changes in the fields where the filtering of either liquids or gases is of importance. Filtros tile are essentially silica, will easily withstand any temperature up to 1600°F., are practically unaffected by acids and by such weak alkalies as are in commercial use where filtration is required. The pores are so fine as to offer great resistance to the penetration of even the finest slimes; yet the mass is itself so porous as to allow the comparatively free passage of the gases or liquids to be filtered.

Filtros should not be confused with the material at one time manufactured by the Just Process Co., termed "silica sponge"; although, in a measure, developed therefrom. There were many points of excellence in these Just Process plates, but use developed the fact that they were not only affected by acids, but were by no means uniformly porous. The installations made in connection with the cyanidation of ores, the filtration and clarification of solutions, and in the saving of flue-dust in smelting operations, etc., demonstrated that the making of a highly siliceous septum which would be of high and uniform porosity, and unaffected by either acids or weak alkalies, would open up a wide field for its use.

During 1913, J. Edward Porter of Syracuse, N. Y., who had much to do with the development of the original plates, discovered a method for producing the plates which had all the desirable features just mentioned. The result is the Filtros tile. Applications for patents covering the various features of the Porter inventions have been filed and broad claims allowed. The General Filtration Co., Inc., acquired the Porter patents and subsequently all the patents owned by the Just Process Co. Under arrangements made by the General Filtration Co., Inc., with the Harbison-Walker Refractories Co. of Pittsburgh, the latter has developed the commercial production of the tile, and manufactures them on the order of the Filtration company.

The ware is white and porous, of excellent hardness and strength and may be made in varying degrees of porosity. The standard size of tile is 12x12x1½ in. and where it is possible to do so, there are advantages in so designing the filtering apparatus as to use this size. A great variety of shapes, however, may be made when necessary.

Among a large number of solubility tests the following will be of interest:

Solutions	Strength	Time Immersed (Temperature 200° F.)	Loss %	Condition
Sulphuric acid....	96%	24 hr.	0.02	Unchanged
Nitric acid..... Hydrochloric acid	⅛ of 38% ⅛ of 70.5%	24 hr.	0.02	Unchanged
Distilled water...	....	24 hr.	0.00	Unchanged
Sulphuric acid....	20%	35 days	0.11	Unchanged
Hydrochloric acid	20%	35 days	0.14	Unchanged
Nitric acid.....	20%	35 days	0.08	Unchanged
Saturated solution of zinc sulphate	....	20 days	0.04	Unchanged
Potassium cyanide	0.50%	20 days	0.09	Unchanged

*From information furnished by the General Filtration Co., Inc., Farmers' Bank Bldg., Pittsburgh, Penn.

Other tests make evident its resistivity to organic acids as well. The remarkable uniformity in the porosity of the tile will bear emphasis, particularly important as this is in problems involving aëration and agitation. The following air rating tests will give an indication as to this porosity. These show the number of cubic feet of air per square foot of area per minute that at the given pressure passes through the standard tile 1½ in. in thickness.

	Cu.Ft. of Air at 2-In. Water Pressure	Cu.ft. of Air at 4-In. Water Pressure
Specimen 1	12.0	24.5
Specimen 2	11.7	22.8
Specimen 3	11.4	22.7
Specimen 4	11.7	22.7
Specimen 5	12.0	23.0

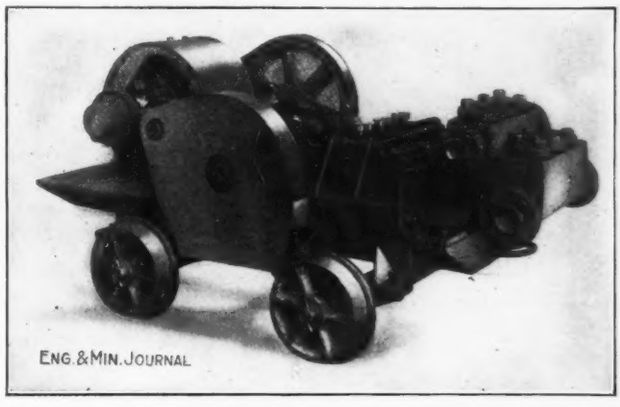
Further indication of the remarkably free flow of liquids through the material is indicated by the following tests as to the amount of water filtered per square foot of area under the given pressures.

Head Pressure	Gal. per Min. per Sq.Ft. of Area	Temperature of Water
5 ft.	1.40	50° F.
10 ft.	2.15	50° F.
15 ft.	2.61	50° F.
20 ft.	3.27	57° F.
25 ft.	3.42	57° F.

To the engineer interested in filtering problems of whatever nature, there will occur numberless uses for which this tile is suitable, such as the filtration of normal commercial acid and alkaline solutions, of gases like blast furnace gases and smelting fumes and the enormous field of water filtration.

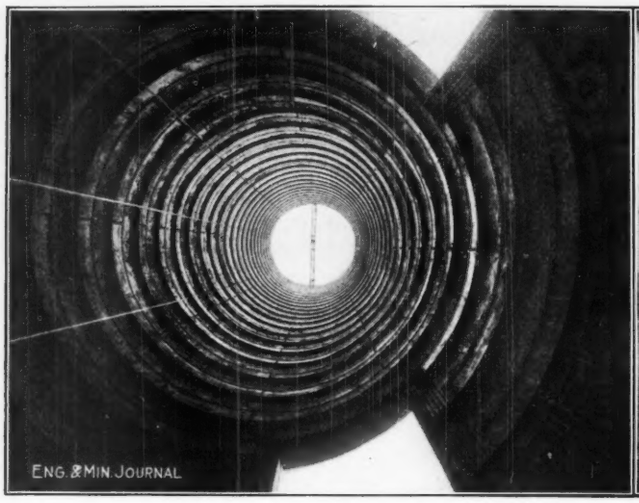
Truck-Mounted Pump

The Goulds Mfg. Co., Seneca Falls, N. Y., has recently perfected and is now selling a portable mine pump, mounted on a truck and designed particularly for pumping out sumps. It is a 4x6-in. triplex pump, electrically operated. Working against a head of 500 ft., the capacity is 65 gal. per min. The truck is of iron construction throughout, and is fitted with adjustable axles, so arranged that if a truck is selected to operate on the widest gage of track in the mine, it can be quickly adjusted to fit any narrower gage. The working parts of the pump are covered by guards, to protect them from grit, falling rocks, etc., and also to prevent injury to attendants. The pump itself is so set that no part of either the pump or the motor projects below the truck platform, thereby eliminating the danger of catching in any material between the tracks.



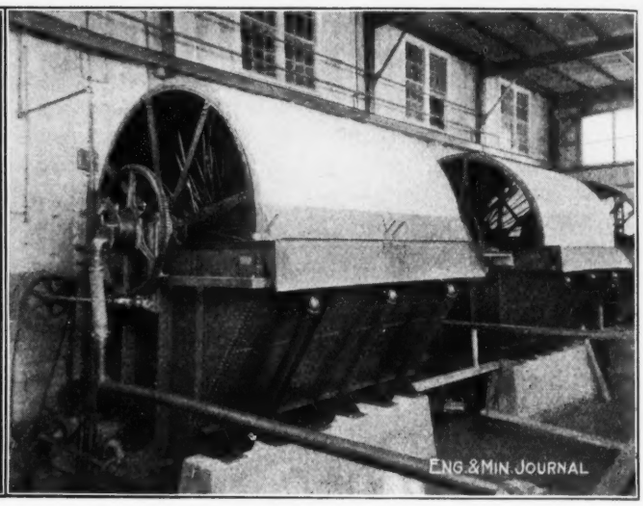
ELECTRICALLY DRIVEN TRIPLEX PUMP ON MINE TRUCK

Photographs from the Field



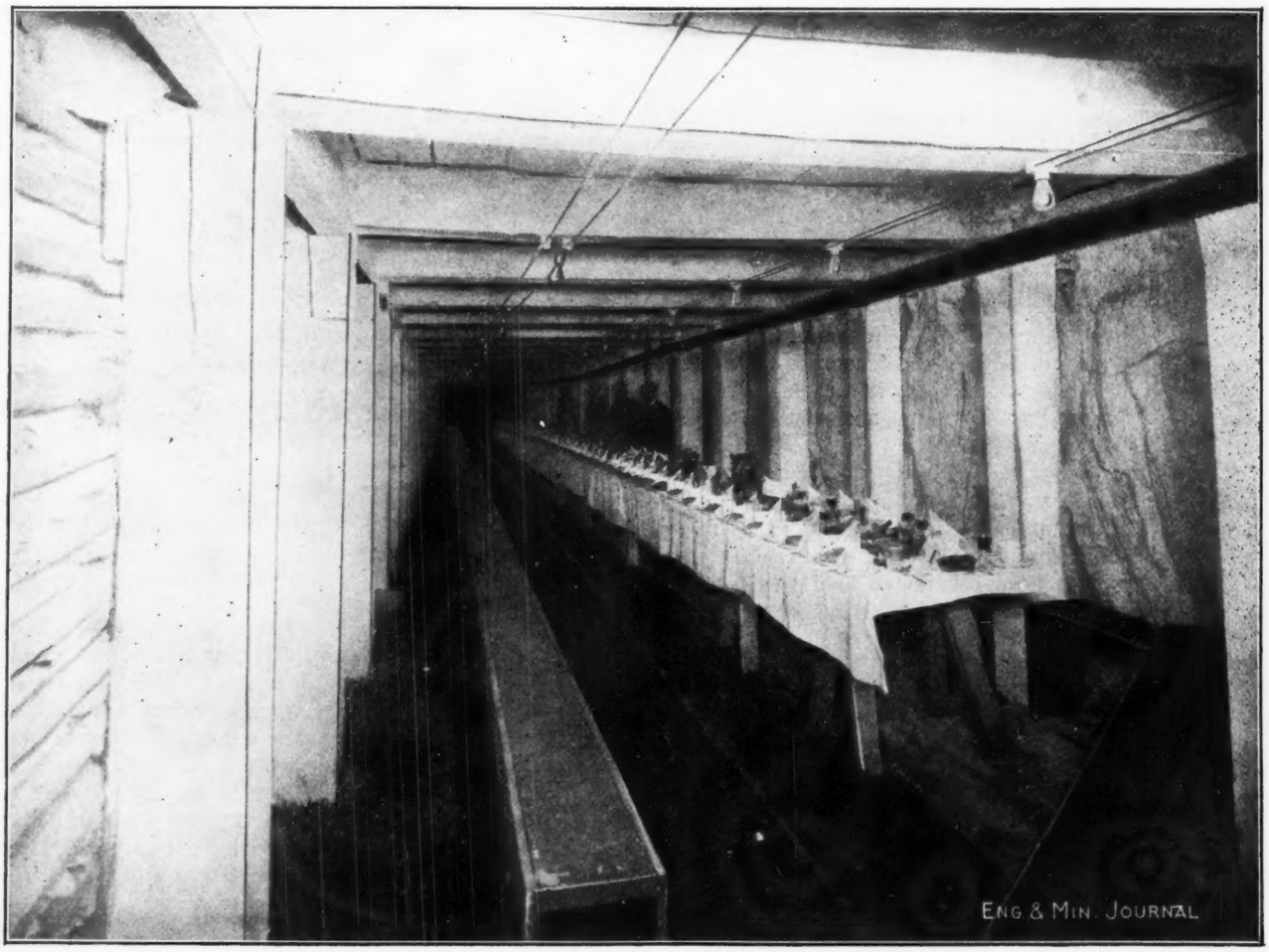
INTERIOR OF A 400-FT. STACK

Looking up the steel stack at the new United Verde smelting works at Clarkdale, Ariz.



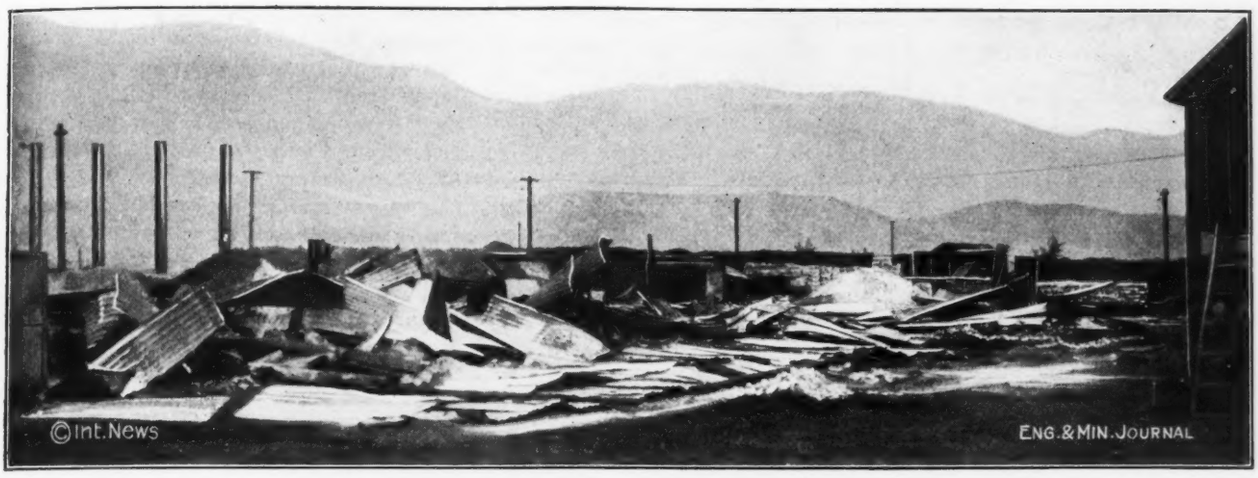
OLIVER FILTERS AT ANACONDA, MONT.

Installed at Anaconda company's plant for dewatering slime-buddle concentrates.



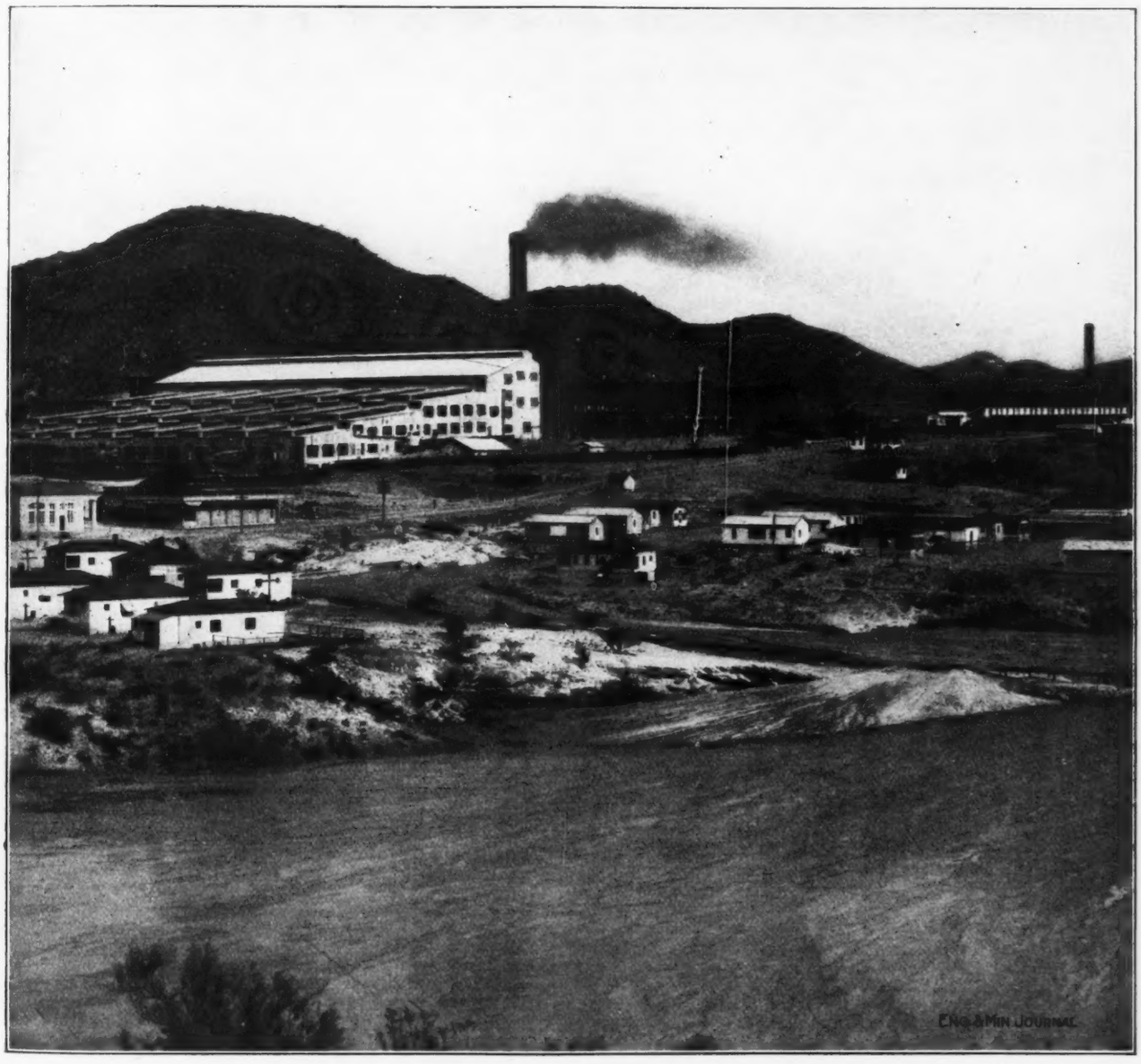
BANQUET ROOM, 2100-FT. LEVEL OF WEST STEWART MINE, BUTTE, MONT.

Table was spread in a drift for 100 visiting street railway officials during a recent celebration in Butte.



RUINS OF NO. 2 SMELTING WORKS AT MONTEREY, MEXICO

Plant was destroyed by the Federals retreating before the rebels; loss, $100,000.



RAY CONSOLIDATED COPPER CO., 8000-TON MILL AT HAYDEN, ARIZ.

The Hayden smelting works, to which the concentrates are sent, are situated back of the concentrator at the base of the big stack, the smaller stack directly in front of it being the power-plant stack.

Copper Mining in Shasta County, California

By Lewis H. Eddy*

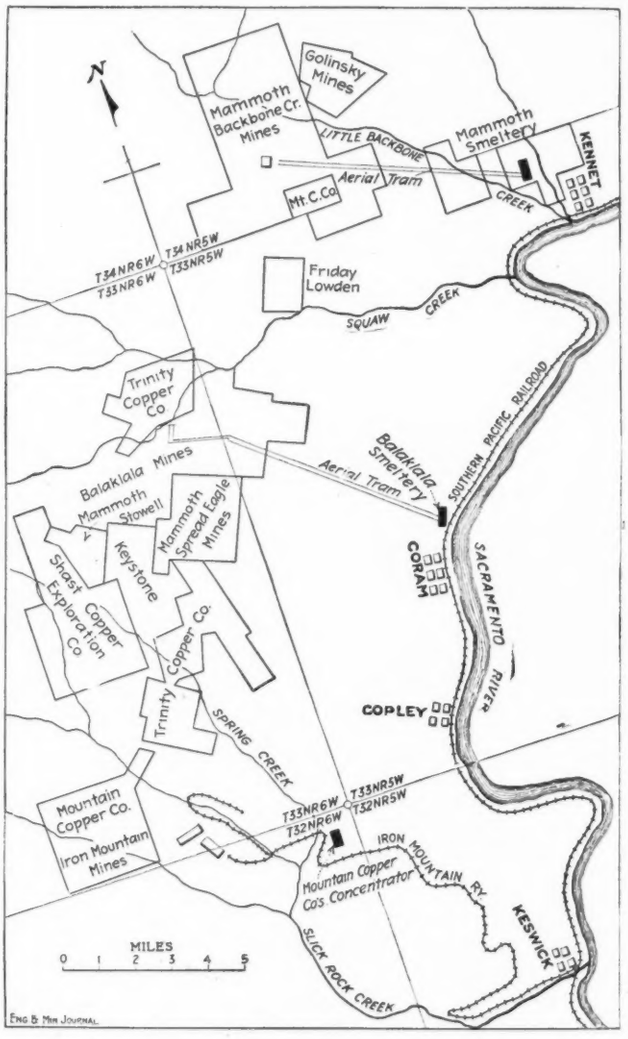
The copper-mining and smelting situation in Shasta County, Calif., in the first quarter of the year 1914 shows a decided improvement over the year 1913. The Mammoth Copper Mining Co. at Kennett has acquired by purchase two large groups of copper-bearing claims and has taken purchase options on other groups of larger aggregate area, making a total in the purchase and the options of about 1500 acres; the mine and the smeltery are both in steady operation. The Balaklala Consolidated Copper Co. at Coram reopened the mines and is shipping ore to the Mammoth smeltery; and is experimenting with the Hall desulphurizing process with prospects of successful application to Balaklala ores. The Mountain Copper Co. is installing a concentrating plant at Minnesota station, situated on Iron Mountain Ry. about 10 miles northwest of Keswick, the former smelter town. The Iron Mountain mines are in steady operation; the smelting ores are shipped to the Mountain Copper Co. smeltery at Martinez on San Francisco Bay; the concentrating ores are stored against the time of completion of the concentrating plant.

The copper-mining activity and improvements are in what is commonly known as the West Side Shasta County copper region, which lies west of the Sacramento River, and is developed for a distance of about 15 miles north and south and five miles east and west.

The accompanying map shows approximately the situation and extent of the principal copper properties, including the Mammoth, Balaklala, and Iron Mountain mines, all operating; the Mammoth smeltery, also operating; the Balaklala smelting plant, where the metallurgical experiments are in progress; and the site of the Mountain Copper Co.'s concentrating plant. The map also shows the Spread Eagle and Stowell groups purchased by the Mammoth and the Shasta Copper Exploration and Keystone groups under option to the Mammoth. The Golinsky and the Trinity Copper Co. mines are also shown on the map.

A large amount of development has been done on the properties taken over by the Mammoth and some ore has been found. The Spread Eagle and the Stowell have been diamond-drilled and also developed by tunnels. Diamond-drilling has also been done on the Keystone and the Shasta Copper Exploration Co. properties. The Stowell has a 1200-ft. tunnel; the other tunnels are shorter. The Mammoth Co. will build a wagon road to the Spread Eagle and will probably install a compressor during this year. All of these properties purchased and under option to the Mammoth are situated between the Balaklala and the Iron Mountain mines. One group of Trinity Copper Co. properties lies between the Spread Eagle and Iron Mountain; the other lies north of the Balaklala. The Golinsky lies east of the Mammoth's Backbone group. Both the Trinity Copper Co. lower group of mines and the Golinsky mines have been developed to a point where production waits only on active mining and reduction of the ores. During the past three years the Shasta Copper Exploration Co. has done a large amount of exploration and development on the West Side, and has kept the section alive by persistent exploiting against the strong odds that the farmers might succeed in killing the copper-mining industry in Shasta County.

The situation in Shasta County is peculiar in that the Mammoth is the only operator that has been in position for the past two or three years to take over any additional mining ground with certainty of immediate returns on the investment. None of the other operators have felt warranted in resuming smelting operations or installing new plants until there should be some certainty established regarding the unmolested operation of a smelting



Shasta County Copper District

plant. The recent expansion of the Mammoth is evidence that the end of the warfare of the farmers is near. The farmers now admit that the crops of the last three years are ample justification of the position of the Mammoth The evidence is positive that no recent damage has been done the crops or the trees or any other vegetation.

Early in 1914 a few members of the farmers' association got together with the purpose of renewing the attack upon the Mammoth, but were unable to interest a sufficient number of members to raise the money required by the attorneys who had been tentatively retained. The proposed litigation was based on the complaint of a farmer near Redding that his young grain was being dam-

*Associate editor, "Engineering and Mining Journal," San Francisco, Calif.

aged by smelter fume. The fact is that the damage was the result of climatic conditions and probably due in some degree to the method of planting and cultivation and the situation of the land. Other grain fields in the immediate neighborhood were not affected, while grain fields 20 to 50 miles further south were in worse condition. In May, 1913, after complaint had been made that the county farm lands and crops had been ruined by fume from the Mammoth smeltery, I visited Shasta County and traveled over the horticultural sections and visited the county farm and other hay and grain lands, and found no evidence of damage.[1] In March, 1914, following the report that damage was being done the grain, I made another visit and traveled through grain fields for a distance of 75 miles south of Kennett. I visited the field complained of and many others. There was no sign of fume damage. But there was at this ranch evidence of discoloration of the blades of the grain stalks, evidently resulting as stated from climatic conditions, and in the immediate neighborhood the young grain was as fine as could be found in any section which had suffered from recent severe rainstorms followed by dry, cold weather.

[1] "Eng. and Min. Journ.," July 26, 1913, p. 153.

The travel included Redding, Cottonwood, Red Bluff, Tehama and Corning and embraced grain fields for a distance of 20 miles through the southern half of Shasta County and 40 miles through the central portion of the northern half of Tehama County. After passing out of the "smoke" belt and into the vicinity of Red Bluff, Tehama and Corning, I found numerous grain fields where the discoloration was much worse than in the field complained of near Redding. In some of the fields the new grain was growing and the discolored blades were disappearing. Evidently the damage was not serious on good land; and there is no probability that the damage, whether serious or insignificant, was the result of smelting smoke. If it were fume damage it is at least peculiar that it passed over the fields in the neighborhood of the complaining farmer in the "smoke" belt and then hit the farmers so hard 40 or 50 miles further away.

Railroad Oil-Land Cases

WASHINGTON CORRESPONDENCE

The long contested issue between the transcontinental railroads and the government, with reference to oil lands, was settled by the Supreme Court in a decision handed down on June 22, in which the view was taken that patents held by the transcontinental railroads could not be set aside by other claimants merely because of their mineral value, but could only be altered through a direct attack by the government if at all, while the view was taken as a *obiter dictum* that the limitation of the time at which the government could take exception to the patent was in the year 1900 or 1901. In handing down a decision in the case, Justice Vandervanter expressed the opinion that in all previous cases of the same kind, the Court had held that where law requires that only mineral or homestead lands are to be granted by the land officials such officials must do their full duty by ascertaining whether the land granted came within the law at the time and could not do it by inserting the provision that if the land should later prove not to be within the law the title should not be transferred. This was practically the attitude taken by the attorneys for the roads, they having urged that it was too late now to introduce testimony to the character of the lands when as a matter of fact that character was passed upon at the time when the grants were actually made.

The decision is expected to dispose of the controversy with reference to the oil lands said to be worth $700,000,000, which have been held by the roads. Title has been contested by various persons on the ground that the finding of oil made the lands mineral in their nature, and hence not properly patented at the time the railroads took title to them. The roads have claimed that the oil deposits did not constitute the lands "mineral" lands and further alleged that in any event, the title that they had acquired could not be attacked, which view the court upheld.

A Mine at the Panama-Pacific Exposition

At the request of various mine operators and the exposition officials, the U. S. Bureau of Mines has undertaken to construct, in coöperation with the mining industry and the manufacturers of mining machinery, a mine beneath the floor of the Palace of Mines and Metallurgy at the Panama-Pacific Exposition.

The financial and operative success of the mine is assured through exhibits promised as shown below whereby typical metal- and coal-mining operations will be reproduced by full-sized working places in which mining machinery will be installed and operated. The walls of the mine will be covered with either ore or coal typical of the mine illustrated. Among others, the Copper Queen Consolidated, of Arizona, Bunker Hill & Sullivan, of Idaho, Homestake Mining Co., of South Dakota, Goldfield Consolidated Mines Co., of Nevada, Jones & Laughlin Co., of Michigan, Lehigh Coal & Navigation Co., of the anthracite field of Pennsylvania, Pocahontas Fuel Co., of West Virginia, Consolidation Coal Co., of Kentucky, and Pacific Coast Coal Co., of Washington, have each agreed to reproduce one of their working places or stopes, and to contribute the sum necessary to the installation and operation. Tentative promises of similar action have been received from the Rock Island Coal Co., Peabody Coal Co., and Pittsburgh Coal Co.

Various mining machinery and appliances have been promised, including a mine cage and cars by the Joshua Hendy Co., a cage, hoist and motor, by the Denver Engineering Works, locomotives by the Westinghouse Electric & Manufacturing Co., pumps by Byron Jackson, air compressor, drills, drill sharpener and winze hoist, by the Compressed Air Machinery Co., drills and coal cutters by the Ingersoll-Rand Co. and the Sullivan Mining Machinery Co., lamps by the Justrite Manufacturing Co., and the Koehler Manufacturing Co., enamel signs by Stonehouse Enamel Sign Co. There is little doubt that other necessary machinery and appliances such as safety lamps, portable electric lamps, fan, mine telephones, mine-rescue apparatus, switches, track, etc., will be received as exhibits.

The entrance to the mine will be through the Bureau of Mines space, and visitors will be attracted to it by being given portable mine lamps, and by being lowered in

a slowly moving cage while a panoramic effect of the strata lining a mine shaft will pass by them so rapidly as to produce the illusion of descending to a considerable depth. In case of crowds, these may enter by a slope. Exit will be by a slope into the radium booths of the Bureau of Mines where radium emanations will be shown.

There will be a motion-picture room which visitors will pass in going from mine to mine. In it will be shown such great open workings as are not illustrated by the underground mines, such as those of the Utah Copper Co. and those of the Nevada Consolidated, at Ely, the iron properties at Hibbing, Minn., hydraulic gold mining, and the quarrying of building stone.

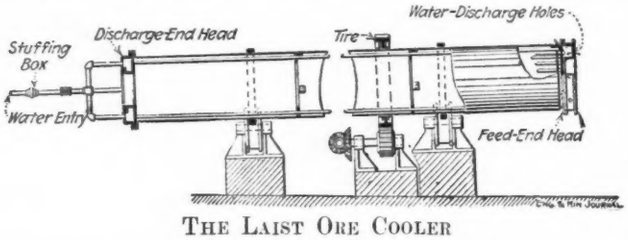
Twice each day there will be an imaginary explosion or fire in some portion of the mine announced by telephone to the superintendent's office in the Bureau of Mines space on the surface, and rescue men wearing breathing apparatus will enter the mine and bring out supposed victims, who will be given first-aid treatment in the surface emergency hospital.

In the Bureau of Mines space on the floor of the main building, there will be, in addition to the radium booths, exhibits of carnotite, pitchblende and other radium ores, their alloys and concentrates, an emergency mine hospital and smoke room for rescue training, exhibits of fuel efficiency, smoke abatement, explosives, mine-welfare work, etc.

The prime purpose of the mines will be that of educating the investing public, stockholders, members of legislatures and the uninformed antagonists of the industry relative to the importance of the mining industry, its extent, variety and the cost of operation.

Laist Ore Cooler

A machine for cooling roasted ores has been patented by Frederick Laist, of Anaconda, Mont., under U. S. No. 1,090,549. The particular object has been to provide a cooler which would perform its principal function



THE LAIST ORE COOLER

satisfactorily, and at the same time permit the shell to expand or contract, under the influence of varying temperatures, without producing a strain on any of the parts or interfering with the operation of the machine.

The objects are accomplished by having a tubular sheet, the interior surface of which is covered with longitudinal water pipes, which perform the cooling. At the discharge end of the tube, slightly lower than the feed end, the pipes fit into an annular water chamber, through which cooling water is supplied. At the feed end there is another water chamber, but this is separate from and outside of the actual head of the tube through which the pipes pass, free to move as the shell expands.

The machine is mounted on tires resting on rollers, the latter being wide enough to allow for any possible expansion of shell. The accompanying drawing shows the details of the machine.

James Moore Swank

James Moore Swank died in Philadelphia, June 21, aged 81 years. He had been in failing health for over a year, but the end was unexpected. He was born in Westmoreland County, Pennsylvania, his parents moving to Johnstown when he was a boy. His first work was in a newspaper office and later he became editor and publisher of the Johnstown *Tribune*, which for years was a power in Whig and later in Republican politics. In 1869 he went to Washington and served for a short time in the U. S. Department of Agriculture. In 1872 he took an active part in the organization of the American Iron & Steel Association, with which he was connected for over 40 years.

This association was at first founded to support and advocate the maintenance of a protective tariff as a necessity for the iron industry. In preparing the literature which it circulated, Mr. Swank became interested in collecting statistics of the industry and this work was gradually extended until the Association took in practically the whole of the trade in this country. Herein he developed his real mission, for he was a born statistician and very few excelled him in the thoroughness of his collection of facts and the care with which they were arranged and recorded. He was most conscientious and careful in his presentation of facts and for many years the American iron and steel industry has had in its annual reports a more complete chronicle of its work than has that of any other country.

Gradually, the Association dropped its original purpose and became purely a statistical organization, existing only for the collection and publication of the figures of the trade and their publication in a periodical "Bulletin." Mr. Swank never forgot his original purpose, however, and in the "Bulletin," he persistently urged the protective tariff and its benefits. He found time, also, to write several books which are of standard value as reference, relating chiefly to the early history and growth of the iron trade in this country. He also published, in connection with the "Bulletin," a triennial "Directory of the Iron Trade," which is a very complete work of its kind.

He remained secretary of the Association for 12 years, and in 1885 was given the title of general manager, which he retained until his death. In fact, for most of the time after that, he was practically the Association, the iron men supporting the statistical bureau and its publications by their subscriptions, but taking no active part in the management. Two years ago he was compelled to resign on account of his age and failing health, and it was decided finally to close up the Association and to transfer its work to the American Iron & Steel Institute, which organized a statistical Bureau for that purpose. This Bureau took over Mr. Swank's assistants and the staff which he had gathered around him, so that the work was continued on practically unchanged lines.

Mr. Swank was not only an able statistician, but he was a thoroughly honest man and his uprightness and singleness of purpose were highly respected, even by those who did not agree with his opinions. His death will be generally regretted, as was his retirement two years ago.

The Anglo-Egyptian Oilfields, Ltd., has deepened its No. 13 well and according to the London "Financial Times," brought in a gusher that flowed at the rate of 4000 tons per day.

Correspondence and Discussion

Chloridizing the Sudbury Copper-Nickel Ores

From a careful reading of Arthur Howe Carpenter's article on the chloridizing of Sudbury copper-nickel ores, in the JOURNAL of May 30, 1914, with the view of making the iron-nickel portion into ferronickel, it is evident that Mr. Carpenter is not well acquainted with the ores of this district. Granting that the Longmaid-Henderson process will do all that he claims it will in removing the copper from the ore that alone does not solve the metallurgy of these ores, so far as making ferronickel is concerned. In treating these ores one has to treat what the mines produce and these mines do not produce an ore that is fit for smelting into ferronickel by simply removing the copper and sulphur.

Generally speaking, the run-of-mine ores are about one-half rock and will carry from 32 to 48% insoluble or 20 to 30% SiO_2, with only about 40 to 25% Fe. Such ore is too high in silica and low in iron to warrant smelting into pig iron even if it does carry from 1 to 2% Ni.

None of these ores is high enough in copper to call it even a good-grade copper ore. Most of the ore that is available for smelting into ferronickel carries from about 0.25 to 0.75% Cu. This copper is not evenly distributed through the ore, but much of it runs in streaks and bunches. The great bulk of the ore fit for making into ferronickel will not run over 0.25 to 1.50% Cu, and such rocky ore can be crushed and separated magnetically to give a product much better fitted for smelting into ferronickel than can be gotten simply by the Longmaid-Henderson process.

For instance, take the following run of mine ore, which is a fair average for much of the district: Insol., 39.10%; Cu, 0.88; Ni, 1.50; Fe, 31; S, 16.70%, an ore anything but inviting for smelting into pig iron even if all the copper was leached out and all the sulphur roasted off. Neither has such an ore any commercial value for its sulphur.

This same ore was hand picked with the following results:

	10% Concentrate	90% Reject
Insol.	19.10	41.00
Cu	0.13	0.95
Ni	1.62	1.45
Fe	40.00	28.80

When crushed and magnetically separated, it can be made to yield a product carrying as low as 0.17% Cu with insol. 15%; Fe, 48; Ni, 2.50, and S, 28%. By crushing finer the Fe and S can be run several per cent. higher, the insoluble largely eliminated and the copper brought down to 0.10%, or about the Longmaid-Henderson limit. In separating the ore magnetically to remove the copper it is preferable to keep out and pick out the richest copper ore when the ore averages over 0.50% Cu.

I quite agree, however, with Mr. Carpenter that the correct solution of the metallurgy of these ores, especially the lower-grade ones, is to convert the iron and nickel portion so far as possible into ferronickel for steel making. More nickel and copper can be saved this way and the iron which is now thrown away will pay most of the working costs.

D. P. SHULER.

Fredericktown, Mo., June 5, 1914.

Gold and Silver in Oxidized Zinc Ores

In the advance chapter from Mineral Resources of the United States, "Precious and Semiprecious Metals in Utah in 1912," by Victor C. Heikes, my article in the JOURNAL, of June 21, 1913, "Occurrence of Oxidized Zinc Ores at Tintic," is mentioned.

Mr. Heikes quotes from this article describing the occurrence of the zinc-carbonate ores at the Yankee and May Day mines, and includes a statement of mine to the effect that there is no gold or silver in the ores. Immediately after, he says, "The average assay of zinc ore shipped from the May Day mine in 1912, was 0.027 oz. of gold, 2.20 oz. of silver, and 2.57% of lead, but these metals were not paid for by the zinc buyers, and therefore arises the erroneous supposition that there is no gold or silver in the zinc ore at either the May Day or Yankee properties." This statement by Mr. Heikes has recently been referred to by G. F. Loughlin in an article on "The Oxidized Zinc Ores of the Tintic District, Utah" (*Econ. Geol.*, January, 1914).

The zinc ores occur along the bottom of the old lead stopes and the gold and silver mentioned by Mr. Heikes are due to an admixture of lead ore, or to the siliceous limestone or casing in the neighborhood of the lead orebodies.

In order to find out whether the gold and silver occur with the zinc, samples of clean zinc ore from the May Day and Yankee mines were obtained, and assayed for gold, silver, lead and zinc as follows:

ASSAYS OF MAY DAY ORE

Sample No.	Description	Zinc %	Gold Oz.	Silver Oz.	Lead %	Copper %
1.	Banded smithsonite ore; radiated structure; pale green to yellow and white	50.3	none	none	trace	....
2.	Pale green, white and yellow smithsonite ore; banded	50.4	none	none	0.0	....
3.	Brown and white zinc carbonate ore; porous; cavities lined with druses of small calamine crystals	50.4	none	0.12	trace	....
4.	Pale greenish smithsonite with unusually large amount of auricalcite and copper-stained portions; some iron	48.9	none	none	0.0	0.66
5.	Smithsonite ore with radiated structure; cream colored to white	41.1	none	none	0.0	....
6.	Aggregate of yellow, pale green and white crystalline minerals; some iron; cavities lined with small colorless crystals	44.9	none	none	0.0	....

A composite sample of Nos. 1, 2, 3, 4, 5 and 6 assayed for insoluble, gave 3.2%.

Pure smithsonite contains 52% zinc.

From this it will be seen that there is little gold or silver with the zinc in the May Day ore. Sample No.

3 is the only one to show silver, carrying 0.12 oz.; none of the samples carried gold.

The May Day lead ores run well in silver, carrying 20 to 30% lead, with one-half to an ounce of silver per unit. Compare the contents of lead and silver in the assay of zinc ore, given by Mr. Heikes. At present, ore running over 50% lead, high in silver, and carrying some gold, is being mined.

ASSAYS OF YANKEE ORE

Sample No.	Description	Zinc %	Gold Oz.	Silver Oz.	Lead %	Copper %	Insol. %
7.	Banded smithsonite ore retaining folds and structure of the limestone; porous; considerable auricalcite..	48.0	0.015	2.4	0.0	0.59	9.6
8.	Pale green to brown zinc carbonate ore; aggregate of small crystals with botryoidal structure; considerable limonite.....	47.7	none	0.5	0.0	....	4.2
9.	Banded gray and white smithsonite ore; some auricalcite lining cavities.....	48.1	none	1.3	0.0	0.78	8.8
10.	Compact gray zinc carbonate ore with some copper.....	48.9	none	0.8	0.0	0.56	4.5
11.	Yellowish zinc carbonate ore translucent in part; some iron, druses of colorless crystals lining cavities	48.5	none	0.16	0.0	....	3.6

These samples from the Yankee mine show a maximum of 2.4 oz. silver and 0.015 oz. gold in sample 7. Sample 9, the next highest, carries 1.3 oz. silver. These two highest assays for silver carry a relatively high percentage of insoluble, 9.6% and 8.8%, respectively, about twice the amount of insoluble in the other samples from the Yankee, and nearly three times that in the May Day samples. The gold and silver in these samples are undoubtedly associated with the silica. Siliceous ores carrying these metals are mined at the Iron Blossom, Eagle & Blue Bell, Chief Consolidated, Mammoth, and other Tintic properties. The amount of gold and silver in the two highest samples from the Yankee is hardly more than that carried by the country rock in the neighborhood of the orebodies in the Tintic district.

The possible occurrence of the gold and silver with the copper-bearing portions of the zinc ore, i.e., in zinc carbonate coated with auricalcite, was looked for in samples 4, 7, 9 and 10, but it does not appear to occur.

The assays for lead, zinc, copper and insoluble were obtained through the courtesy of E. P. Jennings and W. A. Barnes, of the Utah Metal Mining Co., of Bingham. The assays for gold and silver were made by the Union Assay Office, Salt Lake City.

While gold and silver occur with zinc sulphide ore, or with the accompanying pyrite or galena at various localities, there are no cases on record where these metals are associated with the leached or secondary ores of zinc. Regarding the oxidized zinc ores, at Leadville, G. Montague Butler says:[1]

> It is true that the relatively high specific gravity of the smithsonite long ago attracted attention, but all curiosity seems to have been satisfied when it yielded no or very low assays for gold, silver, lead, manganese and iron. Everyone called it lime, although 50% too heavy.

Zinc is the most mobile of all the metals of ore deposits in contrast to lead, which shows little mobility. Blende oxidizes rapidly to easily soluble sulphate, especially when pyrite is present. Gold shows little mobility and is almost stationary as compared to copper and zinc. Silver sulphide, argentite, is almost insoluble in water or in dilute sulphuric acid. The oxidation of argentite at the surface leads to the formation of cerargyrite, often by metasomatic replacement.[2]

At Tintic and elsewhere, the gold and silver associated with the original galena or pyrite, under ordinary circumstances being the least soluble of the metals, naturally remain with the lead near the original place of deposition, and do not leach out or migrate with the easily soluble zinc. For this reason, secondary zinc ores carry little or no silver and gold.

EDWARD R. ZALINSKI.

Salt Lake City, Utah, Mar. 18, 1914.

[1] "Recent Developments at Leadville," Econ. Geol., January, 1913.

[2] Lindgren's "Mineral Deposits," pp. 792 to 796.

What Becomes of All the Mining Engineers?

In the JOURNAL of May 30, 1914, is an article by J. I. Blair, of Coffeyville, Kan., who is said to be a mining engineer, on "What Becomes of All the Mining Engineers?"

I am somewhat surprised to see such an article printed without comment. What becomes of the mining engineers, metallurgists and engineers from colleges? If Mr. Blair doesn't know, he ought to find out. I won't argue with him on the nonferrous metalliferous works, as I am not as familiar with them as with steel plants, but I feel satisfied he is as wrong there as he is in his reference to the steel works.

The steel mills are full of engineers and college men, who do the best kind of work and head practically all of the big departments. Some presidents and vice-presidents of a large number of plants are college men—engineers. The general superintendents, blast-furnace, coke-oven and openhearth superintendents are by a large majority college men—engineers. The heads and assistants in the mechanical, electric, steam engineering and similar departments are mostly college men, and scattered all through the mills you find college men—engineers—engaged in special work or working their way up to responsible positions. The laboratories are practically all headed by college men.

If an engineer gives up his line of work it is because some special opportunity offered to call him away from his professional career or because he was not fitted for it. If an engineer or college man goes into the work he must expect to work hard, work his way up, gain his experience and make himself useful. If he expects to become a superintendent after six months and is not willing to work for it, he will fail and probably make such statements as contained in the article referred to.

A college education is the greatest blessing a young man can get. If he has sense and is willing to work his way up, no one appreciates such men more, is more willing to give them every chance, and gets better results from them than the average manager of our great steel plants. I know hundreds of them and I take off my hat to trained, steady, hard-working college men when it comes to getting results in our mills. There is room for every one of them that will work.

C. A. MEISSNER.

New York, June 2, 1914.

Editorials

Co-operation between Capital and Labor

In spite of the never-ending warfare between employer and employee, the interests of the two parties are in the main identical. They may contest about the division of the returns of their industry, but to get any returns at all they are bound to work together. This must be in the process of being made evident by the developments in the railway situation. The railways have been repeatedly obliged to grant increased wages and moreover to employ extra men, not really needed. This has reduced the railway net earnings; in some cases nearly to zero. The railways have sought to raise their returns by raising freight rates, but have been unable so far to do so, the Interstate Commerce Commission, representing the public, having stood in the way. In the meanwhile, the railways have been reducing expenses by reducing service. The *Wall St. Journal* has reported that 34 railways operating about 136,000 miles of road are now employing about 120,000 fewer men than at the same time in 1913. If the remaining roads have reduced in the same proportion the total reduction would be 240,000 men, but probably it is less than that, some of the prosperous great Western lines not having been included in the returns.

However, there has been unquestionably a great liquidation of labor, not only in transportation, but also in mining and manufacturing. Of what avail is it to organized labor, especially the railway men, to win increased wages or employment for unnecessary men and then lose their jobs or be put on part time?

In a recent article in *Engineering Magazine,* Doctor Douglas dwelled upon the destructiveness of the labor movement as heretofore conducted and with his philosophic perception pointed out whither it is leading us, and urged a better recognition of things as they are and must be; and a better attention to the principles of co-operation Among other things, he said:

> But it should be possible to devise a scheme by which capital and labor would coöperate to the mutual benefit of both. Consolidated capital, applied to industrial operations, receives profitable return only when correct business methods are employed; and as a rule individual manufacturing or trading concerns are successful financially because they are engineered by some single head of consummate ability. He is often a man who has risen from the ranks, but when rising he passes out of the workingman's class into the capitalistic class, and does not carry his fellow workingmen with him. This is not necessarily because he lacks sympathy with his fellows, but because no adequate machinery exists for throwing the forces of labor and capital into the same channel. Profit-sharing has been tried, and is possible in communities of settled population, where the shop or the mill or the mine, and the men who own it and operate it, reside in the locality permanently from generation to generation. It is difficult to apply it to our shifting industries and industrial population. But surely some other method of mutual participation in the common welfare might be devised. For instance, if labor unions were incorporated, and their leaders were made answerable for the administration of their funds, and the surplus funds were used for investing primarily in the securities of the identical enterprises in which the men were themselves working, the men would thus become joint owners in the company. The amount that a single workman could invest would be so small as to give him individually an insignificant influence; but the accumulated investment of a number of men, handled, through proxies or otherwise, as a single unit, might carry a commanding voting power, and be great enough to secure representation on the board. Should that happen, the influence of a highly intelligent workman, more intimately in touch with the technical operations of the company than the average director, would be at once felt and would command respect.
>
> While not overlooking the disqualification under which the workman labors to improve his condition materially, or disparaging for a moment the excellent intentions and the beneficent results of private philanthropy and legitimate legislation, the fact is nevertheless patent that neither the private nor the public friends of the working classes urge upon them the practice of the virtue of temperance and prudence in their modes of living, or of honesty in their dealings with their employer. Under the assumption that they are no better than slaves of their masters, they are encouraged to do as little and to extort as much in return as possible. In fact, the men know that on their coöperation the success of many enterprises largely depends. Syndicalism encourages them in this belief. But if instead of wrecking an industry under the sabotage methods, in order to become possessors of ruined and discredited businesses and plants, the men could see a way of becoming shareholders, they would participate in the work of a living organism instead of attending its funeral. Moreover, they would help to improve the operation of the concern, not only by throwing greater energy into their work, but still more by adding their better knowledge of operating details to the greater business aptitude of the office force. This desirable result could be brought about only by coöperation among the men. It would be assisted by joint coöperation on the part of the companies—by not opposing labor representation on the board. The general impression among the men that their presence there would be looked on as an intrusion, and that every means would be used to neutralize their influence, I think would be soon dispelled, provided their representative did not adopt the attitude of setting at defiance all the customary usages of such consulting bodies, and of that there is probably but small danger. In the many prolonged conferences between workmen and company officers, where they have met at the same council chamber, the reverse of that spirit has been exhibited.
>
> Even such small scattered holdings as the men now have, say in the subsidiary companies of the iron and steel industries, if held and voted as a unit, would constitute a notable factor. Their full influence might be secured through proxies, but as powerful a force would not be exercised by each man acting for himself, as if the total holdings of all the men were handled by a holding committee. The men would be borrowing methods from their masters.
>
> In most manufacturing and mining enterprises men are well paid, and, if the inducement to save were stronger, the amount accumulated for investment would be very considerable. And if the investments were made in the funds of the companies for which the men work, it would not only give them a voice in the management, but it would also give to the enterprise itself a more stable character; for men who have an interest in the work would not come and go as is their wont, nor throw up their jobs on the most trivial excuse. They would, as shareholders, look at the works as their own, and take in them the pride of ownership.

There are numerous corporations big and little that are doing this very thing, i.e., interesting their employees as stockholders, making them veritable partners in the business. The biggest corporation of all—the U. S. Steel Corporation—is a leader in this movement.

At the last annual meeting of the stockholders of the Steel Corporation several of its employee-stockholders, holding the proxies of their fellows, were present, and with Judge Gary in the chair the doings of the company, especially as related to its employees, were discussed. Several of the workmen made interesting statements as

to the existing conditions in the steel industry in so far as working conditions are concerned. One of them, Mr. Maitland, remarked "This corporation is doing more for humanity than the United States is doing for humanity." Another, Mr. Smith, said: "I sometimes feel that some of our demagogues who pretend to be the laborers' greatest friends, after all are the laborers' greatest enemies."

It certainly is a new departure in the meetings of corporations when individual stockholders, who are employees, appear and speak in the strain they did at the Steel Corporation's meeting. May not this growing movement be the dawning of a better day and a clearer understanding between employer and employee? And may not the demagogues now rampant in Washington and the self-seekers now paramount in the council rooms of organized labor find that they have been backing the wrong horse?

The Labor Troubles at Butte

A falling out in the councils of a labor union is no new thing. We recollect the days of the Western Federation of Mines when Brother Moyer and Brother Haywood ran its affairs in a brotherly way, but they fell out and Brother Haywood started a trouble-making union of his own. There is no reason to expect the heads of labor unions to be always more brotherly than trust magnates, of whom only the fraternalism of wolves is expected.

The recent trouble at Butte was in no wise a difference between the companies and the miners' union. The companies pay the highest wages going and raise the scale when the price for copper rises. As between the miners' union and the companies, everything has been agreeable, and everybody hopes that things will continue so.

However, Butte has always been the scene of squabbles with other unions. It is rare that one goes to Butte without learning that the pipefitters, or bricklayers, or plumbers or electricians or somebody else is out on strike for higher wages or easier hours or some intolerable demand. In these *guerillas* the miners have stood stanchly by the companies and have staved off any sympathetic strike. Indeed, it began to dawn on the miners that it was themselves who suffered from further exactions; that when the cost of rent, transportation, etc., was increased it came out of their pockets. Butte has always been a high-priced town and when wages have been raised, landlords and shopkeepers have exhibited a tendency to raise things on their own account, wherefore Jack Miner found himself no better off.

There have been other things to think about also. Many of the older miners have sons about grown up to the working age. Try to gild it as we may and speak about mining as a noble and romantic calling, the bald truth is that it is a life of grubbing and drudgery. Knowing this, it is no wonder that many miners are desirous of starting their sons at something better, but when they cast their eyes among the machine shops, power houses and other surface works they do not find it easy to discover entries or secure the union cards that permit working therein.

Something of this sort played a part in the recent ruction at Butte. The union miner has to have a card and has had to exhibit it on occasions to the union officials, who naturally aim to keep track of things. Lately the assessments to carry on the strikes in Michigan and elsewhere have been rather onerous. Butte has been the prime supplier of sinews of war. The local chiefs fell under suspicion respecting their way of doing business. In brief, the miners of Butte did not like the way their affairs were being run and naturally raised a rumpus, the end of which is not yet. The latest accounts tell of a murder and some dynamiting. This, be it understood, is a purely internecine affair.

American Engineers and the Mexican Situation

Whatever the effect of the political disturbances in Mexico may be upon industry in general, it operates with undoubted severity upon American engineers who have been employed in the country or who have built up practices as consulting engineers there. Employment of both kinds has practically disappeared. Mining districts all over the world are flooded with applications, personal and by letter, for employment of any and all kinds, from men who have been forced to leave Mexico. It is unfortunate, but true, that the industry is not large enough to absorb this excess, and many have been forced into other lines. It is to be expected that some of them will never return to mining.

Those who have been forced out of Mexico have not faced the situation with composure. Perhaps the most peculiar phase of it is the almost universal tendency to place the entire responsibility upon Washington. They believe that a different attitude on the part of the administration was required, but what that attitude should have been, differs with every individual, based principally upon his personal needs. One engineer put it baldly in the words: "I know Washington is trying to negotiate peace terms that will be enduring, but I do not care for that. If they will only arrange it so that I can stay four or five years more, I do not care what happens. I will have had enough." Modified as to the term, this requirement will apply to most of them.

The California Oil Land Case

The Supreme Court in its decision on June 22 gave us a final pronouncement that oil lands are mineral lands. The long debated question as to whether petroleum is a mineral and petroleum production a branch of the mining industry may thus be regarded as settled.

With regard to the oil lands of the Southern Pacific Railway Co., in California, the court decided that the patents were irregular, but that they could only be set aside by a direct attack of the Government, the time for which expired in 1900 or 1901.

"In every case before this court," said Justice Van Devanter, who delivered the decision, "we have held that where the law says that only mineral or homestead lands are to be granted by the land officials, the officials must do their duty of ascertaining whether that land came within the law and that they could not perform their duty by inserting exceptions that the land should not pass if found later not to be within the law."

Justice Van Devanter held that a general statute made it the duty of the Secretary of the Interior to inquire whether the lands were of the class for which a patent could be issued. Referring to the practice of the Land Office, the Justice said it had been the uniform practice to decide whether the land was within the limits of the

application when the application was made, and before the issuing of the patent.

This calls to mind the oft repeated charge of Doctor Raymond that the Government, through its bureaus, has been derelict in classifying the public lands. To some extent its dereliction has lately been remedied. However, for many years while interfering with the affairs of private citizens and fussing with work that private citizens could do, it was signally neglecting to attend to its own business.

BY THE WAY

The Senate is going to investigate the use of its stationery by the Gold Hill promoters. It remains to be seen how far the inquisitors will go into the Senatorial playing with a curb market speculation.

⁂

Following the lead of the Harpener Bergbau, A. G. Frau Bertha Krupp has bought nearly 20,000 acres of heath-land in the Prussian province of Hannover and taken it under cultivation. It is proposed to make pastures out of it and stock it with cattle to provide cheaper meat for the employees of the Krupp company.

⁂

Calcium carbide was dutiable at 25% *ad valorem* under the old tariff, and consequently but little or none was imported into the United States. Under the new tariff it is free and Canadian carbide is offered in the market, the monopoly of the Union Carbide Co. thus being broken. In some places, at least, the Canadian carbide is purchasable at a little lower rate than the American.

⁂

The session of the German Reichstag has been closed without having had any chance to dispose of the Petroleum Monopoly bill. This will give the Standard Oil Co. a new lease of life. The amended potash law seems to have struck a snag as it has not been introduced by the government in the Reichstag yet. There are now 168 mines having been allotted quotas and more hustling to get into the pool before a new law is enacted.

⁂

Business conditions and their effect on the Administration trust legislation program were taken up at the Cabinet meeting on June 19, report the press dispatches. Secretary Redfield, of the Department of Commerce, told the President that reports received from many sources indicated that business is unusually good for this time of year, and that prospects were that it would grow better. The President was much encouraged by the reports, and it was said his determination to push the trust bills had been strengthened. We hope that the iron masters, copper producers, zinc producers, etc., will properly appreciate how excellent a thing is psychology. The present situation reminds us of a faith-curer who was trying to persuade a sick old sea captain that he had no pain; that there was no such thing as pain. "Put your finger in the hinge of that door and let me shut it" growled the old sea dog. Business is sick and the political ministrators are faith-curers.

⁂

In early 1914 the Ladies of the Red Cross Society at Berlin instituted an exhibition of gems from the German colonies and of jewelry loaned by the household of the Royal family in which a new gem called "helidore" attracted special attention. Its chief characteristics as published by Hauser and Hersfeld in the *Chemiker Zeitung,* of June. Its color is light yellow with a tinge of green, something like the color of Moselle wine. Specific gravity 2.74. Fracture conchoidal. Its chemical composition is: BeO, 13.88%; Al_2O_3, 18.60%; SiO_2, 66.89%; Fe_2O_3, 0.55%; U_3O_4, 0.02 to 0.04%. The mineral is opalescent and differs somewhat from the several varieties of beryllium compounds in its physical properties. It may be considered a new variety of emerald.

⁂

The New York *American* is opposing the nomination of Thomas D. Jones as a member of the Federal Reserve Board on the ground that he is a trust magnate, and consequently an oppressor of the poor. The *American* says:

> Thomas D. Jones is president of the Mineral Point Zinc Co. and a director in the New Jersey Zinc Co., familiarly known to the independent operators in the trade as the "zinc trust."
>
> The president of the "trust," which has offices at No. 55 Wall St., is Stephen S. Palmer, who is also treasurer and director of Mr. Jones' Mineral Point Zinc Co.
>
> Independent zinc manufacturers complain that under the Underwood tariff bill a duty of 10% ad valorem is imposed on all the zinc contained in low-grade zinc ores, which were admitted duty free under the "high protection" tariff.
>
> As practically every ton of zinc ore in this country is controlled by the combine, independents are forced to pay the price set or stand the cost of the tariff. The reason for abandoning the free raw materials theory in this particular case never has been explained. Many independents are said to be practically facing bankruptcy.

For a collection of things that "ain't so" it would be hard to beat the foregoing. Ask anybody acquainted with the zinc business.

⁂

The Colombian Emerald Co., Ltd., which had an exclusive concession from the Colombian government for the mining of the Muzo emerald deposit, has been in difficulties with that government for several years. At its annual meeting on June 8, the stockholders voted to dissolve the company and accept an award of £250,000. This sum is somewhat insignificant in comparison with the amount claimed as damages for loss of contract, but the difficulty of fighting a foreign government induced the stockholders to accept the settlement. The Colombian Emerald Co. was formed in 1908 and took over the Muzo property as of Mar. 1, 1909; from that date to Feb. 28, 1910, it produced 30,684 carats of first-grade emeralds, 49,208 carats of second-class, 102,162 carats of third-class, and a large number of inferior stones. In 1910 the Colombian government brought an action against the company in the English courts, claiming rescission of contract. The government took possession of the property and the emerald company entered a counter claim for damages amounting to £1,319,050. The settlement for £250,000, after liquidating the company's liabilities and legal expenses, and the remuneration for the third party who negotiated the settlement, will enable the company to distribute about 25s. per share—equivalent to the return of money embarked in the venture, plus 5% per annum for interest.

PERSONALS

Colonel A. M. Hay recently returned to Toronto, Ont., after examining mining property in Nova Scotia.

A. J. Farabaugh has been appointed general superintendent of blast furnaces of the Bethlehem Steel Co., at Bethlehem.

Professor H. R. Robbins, of the Washington State School of Mines, will spend the summer making explorations in Yukon Territory.

C. B. White is now mine superintendent for the Portland Canal Tunnels, Ltd. W. J. Elmendorf is manager of the same company.

N. O. Lawton, formerly superintendent of mines of the Miami Copper Co., has been visiting some of the copper and iron mines in the Lake Superior country.

William G. Haldane, president of the Colorado School of Mines, was granted the degree of doctor of science at the commencement exercises of Denver University.

E. Saladin, engineer for the Creusot Steel Works in France, has been visiting Canada and the United States. He sailed from New York on June 24 on his return home.

George H. Gray is now purchasing agent of the Tennessee Coal, Iron & Railroad Co., Brown-Marx Building, Birmingham, Ala., succeeding the late William Alexander Major.

Thomas D. Jones, of Chicago, who has been nominated by the President for the Federal Reserve Board, is president of the Mineral Point Zinc Co., and director of the New Jersey Zinc Co.

E. E. Slick, vice-president and general manager of the Cambria Steel Co., Johnstown, Penn., has been made a director of that company and also of the Pennsylvania Steel Co., Steelton.

N. W. Sweetser for three years past engineer of the Phœnix mines of the Granby Consolidated Mining, Smelting & Power Co., has been appointed superintendent of the Hadley Alaska mines of the same company.

James Wilding, Jr., formerly of Parral, Mexico, has been at the mill on Four-mile creek, Slocan, B. C., of the Silverton Mines, Ltd., operating the flotation plant put in there by the Minerals Separation American Syndicate.

F. A. Heinze is reported by his attorney to be in very bad health and unable to leave his home; consequently he is unable to appear in certain litigation, resulting from the events of 1907, which is still pending against him.

Carl A. Meissner, chairman of the coke and blast furnace committees of the U. S. Steel Corporation received the honorary degree of Master of Science in recognition of his services in the manufacture of iron and steel on the occasion of the 50th anniversary of the School of Mines of Columbia University.

H. W. Hardinge left New York June 22, for a combined business and professional trip throughout the northern part of the continent. This trip will include the Cobalt and Porcupine districts, British Columbia and Alaska, and in returning he will take in most of the western mining states. Mr. Hardinge will be gone until about the second week in August.

Norris T. Bush, of Birmingham, Ala., has been elected president of Shelby Iron Co. He is a son of the late Col. T. G. Bush who was president of the company for 20 years. The younger Mr. Bush is a graduate of Vanderbilt university. After leaving college, he took up furnace work at the plant of what was then the Alabama Consolidated Coal & Iron Co. at its Ironaton furnace in Talladega County. Later he was placed in charge as superintendent of the Gadsden furnaces of this company for several years. He left this position to assume the position of general superintendent of the Woodward Iron Co., which he has held for several years.

R. S. Rainsford, who for several years has occupied the position of general manager and mine manager of the Argonaut Mining Co., at Jackson, Amador County, Calif., has resigned from that position, his resignation to take effect on July 1. He will accept a position at Detroit, Mich. During his management the Argonaut has been a large producer, and the property has been well developed. Mr. Rainsford was not only one of the principal witnesses in the apex suit brought by the Kennedy Extension Mining Co., but also directed the examinations necessary to the defendant's case. Mr. Rainsford was also managing director of the Jumper mine, situated near the App mine in Tuolumme County.

OBITUARY

Henry Ralston, founder of the Ralston Iron Works and the pioneer in the iron and steel business in San Francisco, died in that city June 7, of a complication of diseases, which made him an invalid for two years. Mr. Ralston was born in Greenoch, Scotland, 1842. He went to San Francisco, by way of Australia, in 1866, and engaged in the iron business, founding the Ralston Iron Works, of which he remained the head until his practical retirement in 1904. He retained the vice-presidency until his death.

SOCIETIES

Society of Chemical Industry—The annual general meeting will be held at Nottingham, England, July 15, 16 and 17. Dr. H. Sand, University College, Nottingham, is chairman of the committee of arrangements.

Old Freibergers in America—On Saturday, June 13, the members met in New York City in honor of Dr. Friedrich Kolbeck, Rektor of the Freiberg Bergakademie, Saxony. Dr. Kolbeck came to this country to represent the Royal Mining School at the 50th anniversary of the School of Mines, of Columbia University. Dr. R. W. Raymond made an excellent address in German. Franklin Guiterman and F. C. Corning gave the members a treat when called upon to give a toast, and Dr. P. J. Oettinger (Freiberg 1865) told many reminiscences. Dr. Kolbeck recalled some of the men of Freiberg who have advanced the arts of mining and metallurgy and are known the world over. Among those mentioned by Dr. Kolbeck were, Dr. R. W. Raymond, Dr. S. F. Emmons, John Hays Hammond, F. G. Corning, Franklin Guiterman, Dr. Edward Peters, and Prof. Waldemar Lindgren. Dr. Kolbeck said, that as he had come over to help celebrate the 50th anniversary of the School of Mines of Columbia University, he hoped to see a large number of former students of Freiberg back to celebrate the 150th anniversary of the Bergakademie in 1916.

NEW PATENTS

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

AMALGAMATING — Rotary Pulverizing - Amalgamator. Homer R. Bouldin and Rodney Shoemaker, San Bernardino, Calif. (U. S. No. 1,097,162; May 19, 1914.)

BLAST FURNACE for the Smelting or Iron and Other Ores. Thomas Bond Rogerson, Tollcross, Glasgow, Scotland, assignor to The Clyde Furnace Co. ("B") Ltd., Glasgow, Scotland. (U. S. No. 1,099,666; June 9, 1914.)

CONCENTRATING—Improvements in or Relating to Ore-Concentrating Tables. Luhrig Coal & Ore Dressing Appliances, Ltd., and W. Eves, London, Eng. (Brit. No. 12,952 of 1913.)

CONCENTRATION—Support for Concentrating Apparatus. William F. Deister, Fort Wayne, Ind., assignor to Deister Machine Co., Fort Wayne, Ind. (U. S. No. 1,098,023; May 26, 1914.)

CONCENTRATOR. Arthur R. Wilfley, Denver, Colo. (U. S. No. 1,097,113; May 19, 1914.)

CRUSHING—An Improvement in or Relating to Stone Breakers, Ore Crushers and the Like Machines. H. R. Marsden, Ltd., and Neil Taylor, Leeds, Eng. (Brit. No. 17,641 of 1913.)

CRUSHING—Improvements in Ball Mills. C. Mozer, Goeppingen, Germany. (Brit. Nos. 1413 and 1414 of 1914.)

SMELTING—Device for Closing the Tapping-Openings of Smelting Furnaces. Hermann Meyer, Barmen, Germany. (U. S. No. 1,097,345; May 19, 1914.)

SULPHURIC ACID—A Density Regulator for Use in the Manufacture of Sulphuric Acid and Other Purposes. L. Santa. Turin, Italy. (Brit. No. 18,615 of 1913.)

TELEPHONY AND TELEGRAPHY for Mining Cages. Josef Heinrich Reineke, Bochum, Germany, assignor to Studiengesellschaft für drahtlose Grubentelefonie M. B. H., Cologne, Lindenthal, Germany. (U. S. No. 1,098,528; June 2, 1914.)

TIN—Improvements in the Treatment of Tin Ores or Concentrates. E. V. Pearce, care Lloyds Bank, Ltd., Penzance, Cornwall. (Brit. No. 11,612 of 1913.)

TUBE-MILL LININGS, Improvements in or Relating to. J. G. Gibson, Doornfontein, Johannesburg, So. Afr. (Brit. No. 7351 of 1913.)

ZINC—Method of and Apparatus for Recovering Zinc Metal from Zinc Ore. E. Herter, Leipzig-Gohlis, Germany. (Brit. No. 16,035 of 1913.)

Editorial Correspondence

SAN FRANCISCO—June 17

Mt. Lassen Eruption in northern California, which began in a mild way, May 30, gave evidence of subsiding June 17. According to the theories of some writers who visited the mountain, the subsidence and the continued emission of steam indicate another explosion, and possibly eruption. There have been various scientific and other opinions as to whether the disturbance was volcanic, or merely a fissure eruption. There are a number of hot springs in the vicinity, though chiefly on the south side of the mountain, while the eruptions were from a fissure on the north slope of the north peak and about 500 ft. below the summit. This fissure is now about 400 ft. long and 150 ft. wide. Summing up the various statements and descriptions of the disturbance it is quite evident that no crater has been formed, but that the steam and dirt and rocks have come exclusively from this fissure.

Smelter and Fume Agitation is again being stirred up by the action of the State Smelter Waste Commission, created by the last legislature. This commission will submit its report to Governor Johnson in the fall. The commission is composed of Dr. Charles Keane, state veterinarian, Dr. Donald Currie, of the state board of health, and Charles Coo. The commission is assisted by Prof. E. Swain; J. M. Mitchell, chemist; G. J. Pearce, botanical expert; W. E. Burke and George S. Bohart, expert chemists. The act creating the commission gave it mandatory power. The commission may call upon the attorney-general to close every smelting plant in the state, if it is found that the fumes are injurious to plant and animal life. It is reported to the daily newspapers that "the fact is practically established that the Kennett smelters are responsible for plant and animal poisoning within a radius of from 35 to 50 miles from the location of the smelters." It will be interesting to learn precisely what the commission will report to the governor. There has been so much said and written on this fume subject that it seems almost useless to discuss it further. The fact that there has been in the past some damage done to plant life in Shasta County has been taken as an excuse for blaming the smelters for the damage resulting from climatic conditions. The smoke and the fumes reported to be issuing from the crater of Mt. Lassen may furnish another excuse for the farmers to blame the smelters for damage to crops. Mt. Lassen is situated 50 to 60 miles east of the horticultural district of southern Shasta County, and whatever change in the atmosphere may result from the disturbance at Mt. Lassen may be easily attributed by the farmers to the smoke from the Mammoth works at Kennett. It is reported that many of the farmers and stockraisers have retained private counsel to fight the smelting interests. This may, or may not, be true, but there seems to be an end to organized effort by the farmers in Shasta County since their failure in the early part of the year to secure funds sufficient to retain competent attorneys. At that time there was some complaint and proposed litigation was based on the complaint of a farmer, that young grain was being damaged by smelter fumes. In March, 1914, the "Journal" correspondent traveled by automobile and afoot through the grain fields for a distance of 75 miles south of Kennett, and personally visited the field complained of and many others. There was no sign of fume damage, but there was evidence of discoloration evidently resulting from climatic conditions following recent severe rainstorms and dry, cold weather. No doubt, the damage was increased by the lax methods adopted in cutilvation of the soil. In some cases the soil was of poor quality. In the immediate neighborhood of these damaged crops the young grain was as fine as could be found in any section following bad weather. Passing out of the smoke belt it was found that the damage to the grain crops by discoloration was greater at a distance of 70 miles from the smelting works than at a distance of 20 miles. The daily newspapers are stiring up the same agitation regarding Solano, Amador, Calaveras and San Joaquin Counties, where it is claimed that damage is being done by the Selby and the Campo Seco works.

DENVER—June 18

New Tariff on Carload Shipments of Coal from the northern Colorado fields to Denver was recently announced and became effective June 10. While this change was forced upon the railroads by local consumers in Denver who have fought for reduction several years, still the benefit will be felt by consumers in the metal-mining districts of Clear Creek and Gilpin Counties. Shipments of fuel to these counties are obliged to pass through Denver where they are transferred from standard- to narrow-gage cars. The average haul from the mines to Denver is 22 miles and there is no question that the former freight rates were exhorbitant. The rate on lump coal has been 80c. per ton, or at the rate of nearly 4c. per ton-mile. The new rate is 55c. for lump, 50c. for mine-run and 45c. for slack, but these new rates apply only when delivery is made to sidings tributary to the particular hauling railroad. Switching charges for transfer to sidings on other railroads raise each rate 20c. per ton, thus leaving no gain to the purchasers who cannot ship from mines to their yards over a single line of railroad. On the whole, the new tariff is unsatisfactory and there will undoubtedly be more litigation next winter. The railroads affected are the Union Pacific, Burlington and Colorado & Southern.

Padding of Payrolls has apparently been going on for several months at the steel works of the Colorado Fuel & Iron Co., at Pueblo, and recently resulted in postponing pay day for several days pending investigation. Irresponsible papers endeavored to associate the delay with the company's coal-strike troubles and thus to arouse restlessness among the thousands of employees, but, at no time, was there any real danger of a strike for it was well understood among the laborers that their checks had been prepared and were ready for distribution. Officials of the company, especially President Welborn, have been proving that the guilt is chargeable to time clerks and minor bosses. Already eight men have been discharged and the investigation continues. The total sum of the peculations has not been ascertained, but it probably runs into thousands of dollars.

BUTTE—June 18

Revolt in Miners' Union continued Sunday, June 14, after the events of the previous two days, noted in last week's issue of the "Journal." Sunday afternoon crowds began to gather again in the main streets of the city and another riot was threatened when the police arrested several men for creating a disturbance. The crowd immediately rushed to the city jail and demanded the delivery of the arrested men, which was granted without resistance from the city officials. Monday most of the men returned to work in the mines, pending a referendum vote to be taken that Wednesday, June 17, as to whether or not the miners should present their cards upon demand by the walking delegate of the local union as has been customary heretofore. The dispute being at present confined to the members of the local union, the mining companies have taken no steps to adjust the differences or to take sides with one or the other faction. [Late reports are to the effect that revolting miners dynamited the union hall, June 23, in an attempt to capture Moyer, who visited Butte despite warnings to keep away. The miners threatened to lynch him, but he escaped and left Butte.—Editor.]

A Remarkable Fact About Labor Troubles in Butte is that in the long history of unionism there never has been any serious controversy between labor and capital, between employer and employee, but there has often been trouble of a serious nature between unions and members of unions. The present trouble, which threatens to tie up all mines, bring troops into the district and paralyze business generally is trouble between union men themselves. It is a rebellion against the methods of the Western Federation of Miners and its officers, and while some evil and destructive characters, who call themselves I. W. W. leaders, have forced themselves into prominence in the strike leadership, the rebellion is not an I. W. W. movement, but a general rebellion and protest on the part of the miners themselves. They charge the union officers with all manner of corruption and graft, and in their capture of the union records they got possession of original documents that are of a strongly confirmatory nature; 6633 miners voted to sustain the position of the strikers and 243 only voted to stand by the old union and the Western Federation of Miners. Public sentiment in Butte is almost unami-

mously with the striking miners, and affilliated unions are against the federation. President Moyer and executive members have threatened that if the strikers refuse to show their working cards and obey the federation that the smeltermen, hoisting engineers and other unions will be called out. They will probably have a time doing it, for information from the smeltermen is to the effect that they will not obey such an order, but are waiting for an opportunity to join the strike movement against the federation. The hoisting engineers, a perpetually rebellious body, is practically on record, through interviews with its officers and many members, that it will not take part in the pending controversy and will not obey any order of the federation officers to walk out. The mining companies, of course, will, so long as the miners' union can back it up, live up to the contract they have with the Butte union relating to wages based on the price of copper. The federation will make an attemt to furnish miners to take the place of the rebels, but no one believes that it will be able to do so, and generally the opinion is that the strikers will eventually take possession of the old Butte union, reorganize it, repudiate the federation, and that will be the end of Moyer and his organization, for without Butte and Montana to pay their salaries there will be no substance to the federation. For the good name of unionism and the reputation of Butte, it is unfortunate that there has been a bad element mixed up with the striking miners, but their acts of lawlessness are repudiated by the strikers. The I. W. W. have been flocking into Butte for several years under the protection of the Socialist administration and they have been preaching all manner of direct action and violence under police protection or tolerance. The head of the civic administration has in times past preached exactly what has been done by the I. W. W. element in the present disturbances.

SALT LAKE CITY—June 18

Dispute Over Iron Blossom Taxes between Juab County and Utah County as to which shall receive the taxes from the mine in Tintic has come up before the State Board of Equalization. Utah County has been collecting the tax on the net proceeds of the mine, but it was shown that during 1913 two-thirds of the ore shipped by the Iron Blossom was mined in Juab County. That county will therefore collect this proportion of the taxes, as two-thirds of the ore came from well within Juab County lines.

Silver King Consolidated vs. Silver King Coalition partition suit involving certain mining claims at Park City, owned jointly by the two companies, was settled by Judge John A. Marshall in the U. S. district court, June 15. Judge Marshall signed a decree ordering partition by sale of the Vesuvius, Andes, Delaware, Custer, Ladies Drum No. 1, and Mayflower No. 1 mining claims. Inasmuch as the litigants admitted that they were unable to accept partitions without prejudice, Judge Marshall ordered the sale of the properties at public auction. No allowance was given the plaintiff for development done in the Andes claim. The litigants will share in the money received as follows: Vesuvius and Andes, undivided half interest to each; Delaware, Ladies Drum No. 1, Mayflower No. 1, undivided three-quarter interest to the Consolidated, and undivided one-fourth interest to the Coalition; Custer undivided third interest to Silver King Consolidated, and undivided two-thirds interest to Coalition. The sale will be conducted by Charles Baldwin, U. S. commissioner, at Coalville, after sufficient advertising. The ground in question has produced bonanza orebodies, and there is still much undeveloped territory.

HOUGHTON—June 22

Trial of Charles H. Moyer on the charge of conspiracy is scheduled to take place July 6 . Further postponement because of the Butte trouble may be made. This case was removed from Houghton County to Baraga County on Moyer's request. The people here look upon the trial as an expensive joke, as it is going to cost Houghton County approximately $30,000.

Interest in the White Pine Property is keen among the people of the copper country. The White Pine is a subsidiary of the Calumet & Hecla, and is at the extreme southerly end of the Keweenawan mineral belt. Success of this property opens a field for exploration and development extending over many miles in territory which as yet has been untouched. Construction on the White Pine stamp mill is progressing rapidly and the mill will be ready for test runs by October. The mill frame was built at the Calumet & Hecla shops at Calumet. The mill is a few hundred feet from the mine shafts. Instead of steam stamps it will be equipped with gyratory crushers and rolls. In the washing department equipment will be similar to that of any modern milling plant. The first milling plant will treat 1000 tons daily. The White Pine is operated from two inclined shafts and one temporary exploration shaft. One is 1000 ft. deep and the other 900 ft.

Isle Royale's four shafts are now hoisting between 2100 and 2200 tons of rock daily. All of this is not shipped to the stamp mill because a substantial amount is discarded in the rock house, but the mill tonnage is running close to 2000 tons daily and the three-head stamp mill is working to full capacity to crush this tonnage. It is proposed further to increase this tonnage in the near future and then some rock shipments will be made to the Centennial stamp mill at Point Mills. The greater portion of the present Isle Royale tonnage is coming from shafts Nos. 4 and 6 and the physical characteristics of the rock are similar to the average of the Isle Royale lode. There are chances for increasing the amount of rock that is coming from No. 2 and from No. 5 by adding to the underground working force. This likely will be done as rapidly as experienced men can be secured. The underground force now numbers 400. Two shifts are working at the mine, but three at the stamp mill. The best rock is being found in the lower levels to the south of No. 6 shaft. This leads to inquiry as to when operations at No. 7 will be resumed. The certainty of commercial rock in ground which No. 7 will open creates much interest in these results. Drifts to the south from No. 6 went over to the ground of the new shaft and were breasted in good looking rock at that time. Work on the new shaft was undertaken two years ago, but was attended by much difficulty because of the soft, caving ground. In fact the original attempt to get the shaft down to the rock ledge was abandoned and a sand shaft was started. This work was suspended when the strike came and has not yet been resumed.

MARQUETTE—June 20

An Unusual Shipment from the Menominee Range was a recent consignment of 1200 tons of ore to Sidney, Nova Scotia. It is understood that the ore will be used for experimental purposes. The ore was shipped from Escanaba. It was taken out by the steamer "Nevada," a Canadian craft built in England and a type of vessel rarely seen on the lakes. The ship is 230 ft. long, a pigmy compared with the 605-ft. bulk carriers in the Lake Superior trade.

Exploratory Work in the Republic District, it is expected, will eventually be carried on by the Cleveland-Cliffs Iron Co. When that independent corporation recently acquired control of the Republic mine from the Cambria Steel Co., as part of the transaction it came into possession of 7500 acres. The deal was closed only after a careful examination. The Republic is the only active property in its field. Operated since 1872, it has produced to date nearly 7,000,000 tons of ore. Other tracts were explored in the early days, and some were brought to the producing stage. None ever attained importance, however, nor has the far bigger part of the Republic fold ever been systematically prospected. The Cleveland-Cliffs company is a persistent seeker for ore. It has in its service geologists who have given the Marquette range close study. Undoubtedly the Republic field will be carefully investigated and diamond drills will be put to work. It will surprise mining men in general if additional mines are not opened in the years to come. Fire at the Cleveland-Cliffs company's Crosby mine, the only Mesabi range property of that corporation, recently caused $25,000 damage and interrupted mining operations. The engine and boiler houses and the laboratory were destroyed. Repairs are in progress.

TORONTO—June 20

Calgary, the New Oil District, continues to be the center of activity in the West and the most astonishing feature of the whole thing is the facility with which money is obtained for developing the oil leases and the avidity with which oil shares are taken up by the Western public. As a matter of fact, money seems easier to obtain than oil and men who apparently have no money for legitimate investment, are quite ready to subscribe for a gamble in oil. A week or so ago when the excitement was at its greatest in Calgary ,the offices of a prominent brokerage house there were crowded with people waiting to buy oil stocks and found it hard in the rush properly to take care of the checks, drafts and bills that came pouring in. The companies formed to date have a total capitalization of over $110,000,000, and it is safe to assume that over 75% of the properties of these companies are worthless. The general impression of geologists is that while there is a reasonable probability of developing a large oil field in the West that the present center of activity in the Okotoks field to the southwest of Calgary is not likely to result in the development of large producing wells. The chances are that the oil pools will be local and small in extent although Westeners, with that spirit of optimism so typical of the country, will by no means admit it.

The Mining News

ALASKA

GOLD SHIPMENT FROM FAIRBANKS, first for the season, and valued at $300,000, arrived recently at Seattle on S. S. "Humboldt." Gold was brought to Whitehorse aboard first river steamer to reach Upper Yukon this year and came over White Pass & Yukon Ry. to Skagway. In addition to the Fairbanks bullion steamer brought $3500 worth of gold dust from Atlin district.

FIRST CONSIGNMENT OF MATANUSKA COAL arrived lately at Seattle by S. S. "Admiral Evans." The 50 tons of coal will be transported to Bremerton for tests by Navy. Shipment is a portion of 950 tons freighted last winter by Jack Dalton from Matanuska fields to Knik anchorage. All of it will be used in naval tests. S. S. "Admiral Sampson" will bring 600 tons and the "Evans" on her next trip will bring remainder. The "Evans" also brought $6000 in bullion from Valdez.

REPORTS FROM CHISANA received at Cordova June 1 raise expectations as to future of new camp. General impression prevails that $500,000 will be cleaned up this season. Hamshaw has all his boxes in and is ready for sluicing when frost is out of ground, which will be June 10. Charles Range has a steam thawer at work at mouth of Big Skookum. Dahl is getting high pannings from mouth of Rhyolite Creek, three miles below mouth of Bonanza, on left limit of Johnson Creek. There will be sluicing on all claims from mouth of Bonanza to No. 10, also from at least two claims each on Eldorado, Cañon Creek, Gold Run and Big Eldorado. Chase & Hulsdonk are ground sluicing on Bryan Creek which parallels Johnson Creek and expect soon to reach bedrock. They are getting out good prospects, pans running as high as $1.60. It is expected that trail over Skolai Pass will be used this summer and old timers are advising this. Already many loads of goods have been shipped to Russel waiting opening of trail.

APOLLO (Unga)—A 200-ton cyanide plant will be built this summer.

CAMERON-JOHNSON (Valdez)—New machinery is being installed.

GOLD BULLION (Willow Creek)—A new cyanide plant is to be built this summer.

VALPARAISO (Ketchikan)—A plant for development of water power is being installed. Other developments will follow.

JUALIN-ALASKA (Jualin)—This company is contemplating installation of new equipment this season. A large force is now at work.

EAGLE RIVER (Juneau)—Property which has been idle for last two years will be operated this summer under direction of Bart L. Thane.

LUCKY STRIKE (Cordova)—These quartz claims at McKinley Lake have been bonded by a new company which will start development work this season.

ENTERPRISE—Company has been incorporated by Juneau men, with a capital stock of $200,000, for development of property near Limestone. Work will be started at once.

ARIZONA

Cochise County

SOUTHERN ARIZONA MINING & SMELTING CO.—Company has been organized under Virginia laws with $6,000,000 capital, $1,500,000 bonds to take over mines of Imperial Copper Co. in Arizona, as well as plant and property of Southern Arizona Smelting Co., stock of Arizona Southern R.R. Co., and controlling interest in Gila Copper Sulphide Co. These properties were affiliated with Development Co. of America, which met with financial reverses several years ago.

Maricopa County

GOLD IN McDOWELL MOUNTAINS 25 miles north of Mesa has induced many men of that place to go out to the prospects where high-grade ore was recently discovered.

PITTSBURGH TUNGSTEN MINES CO. (Cave Creek)—Company is developing a tungsten property north of Cave Creek. Another tungsten property in same region has recently been bonded to others.

SUNSET (Aguila)—This mill on south side of Harqua Hala mountains is milling custom ore. This stimulates prospecting and some recent discoveries of milling ore are said to have been made.

SOUTHWESTERN MINING & EXTRACTION CO. (Morristown)—Old Montezuma lead mine near the Hassayampa three miles west of Morristown is being operated by this company. Mine was worked by a prehistoric race, evidently for various colored minerals, stone hammers having been found in old workings.

ARKANSAS

Yell County

BLUFFTON GOLD STRIKE has been investigated by G. S. Rogers of the Survey, who reports that seven of the most promising prospects were sampled, great care being taken to gather a reliable average sample of what prospector himself considered his best ore. Despite high returns claimed, gold shown by assay of these official samples in no case exceeded 52c. per ton, and in most of the samples it was 6c. or less. No more than a trace of silver was found in any of the samples. Copper prospects at Steve, and gold prospects at Mena gave similar results.

CALIFORNIA

Amador County

MOORE (Jackson)—This property formerly owned by Capt. W. A. Nevills estate has been taken over by Anderson & Day. It is reported that mine will be reopened.

MAMMOTH TUNNEL (Jackson)—This property at Middle Bar has been purchased at delinquent tax sale by Clarence Anderson, of San Francisco. Mine was a large producer in early days when operated by Capt. W. A. Nevills. It is said to have provided Capt. Nevills with basis upon which he built a large fortune. Mine is developed by a 900-ft. shaft and a tunnel. Ore is treated in a 10-stamp mill.

Eldorado County

MONTANA & EUREKA (Indian Diggings district)—Right-of-way for tunnel across adjoining property has been secured and immediate development of placer claims will follow. Mines have recently been reopened by L. S. Woodbury, of Great Falls, Mont.

Humboldt County

RED CAP (Orleans)—Satisfactory tests are reported to have been made of the tailings from arrastre and installation of a cyanide plant is contemplated.

Nevada County

EMPIRE (Grass Valley)—Paynter rock-drill tester has been installed at this mine. Drill tester is invention of W. D. Paynter, of Grass Valley.

GOLD MOUND (Grass Valley)—This mine, which was closed down at time of disappearance of F. Lewis Clarke, of Spokane, has been reopened by Spokane men.

PENNSYLVANIA W. Y. O. D. (Grass Valley)—Twenty stamps are dropping and mine is reported to be yielding well. Development of new ground in lower levels is reported satisfactory.

CASSIDY (Grass Valley)—Mine is being examined. If report is favorable property will be taken over by George St. John interests, owners of Alaska mine, Pike City, Sierra County.

DELHI (Columbia Hill)—A large body of water was tapped, June 9, by a hole bored into vein, in a drift at bottom of mine. Water filled in to a depth of 50 ft., filling 1200 ft. of drifts. Miners were rescued without injury. It will be several weeks before pumping can be resumed as shaft pump was broken by inflow.

Kern County

MINNEHAHA (Randsburg)—Vein of high-grade ore has been disclosed in winze. Mine is on same belt and strike and ¾ mile distance from Yellow Aster.

San Bernardino County

ATOLIA (Atolia)—It is reported that mine has been opened to lessees. Leases have been taken by McEachin & Son, of San Bernardino, and C. G. Illingsworth; Seth Tyler and J. Custick; Tait & Baker; Besson & Swarthout; Halloway & Niehaus; E. S. Roberts; Cook & Lypps; H. P. Jensen, of Randsburg and Johannesburg. It is reported that a 3-in. vein of tungsten ore has been disclosed on main street of Atolia. Town is a mining village, situated on land of mining company. This ore is said to run 60% tungstic oxide.

Shasta County

MIDAS (Knob)—Sale of this mine is reported. Property consists of 2200 acres of mining claims and timber land, a 20-stamp mill, electric-light plant, a new cyanide plant, also tools and equipment and 5000 cords of wood. Purchase was made by Victor Power & Mining Co., which owns property adjoining Midas. In Victor mine a large amount of development has been done and property is equipped with a modern stamp mill. Victor shaft is 500 ft. deep, while Midas shaft is 1400 ft. deep. Just prior to recent flooding of Midas a rich shoot of ore was reported disclosed in lower levels. Two mines can be worked economically and more profitably under one management. Property will be under management of L. J. Jackson, of San Francisco, and Charles Waste, formerly with Midas, will be superintendent.

Siskiyou County

QUIGLEY (Yreka)—Two cribs, each 40 ft. long, and a smaller crib for a runway have been installed in Klammath River, with shafting and bull-wheel equipment. Installation is for operation of placer mines.

COLORADO

Boulder County

GOLD NUGGET (Boulder)—Ritten & Hemingway lessees have mined some free-gold ore that will be treated soon as old mill is refitted.

SUNSET (Salida)—Three-weeks' run of 5-stamp mill proved so successful that plant will be enlarged to 10 stamps. Mine is 4 miles from Monarch on Pass Creek.

UNITED STATES GOLD CO. (Sugar Loaf)—No. 5 adit is being driven in Livingston vein. Gold occurs as telluride. New mill will probably be ready to run by August.

COLD SPRING (Rowena)—Crosscut adit, now in 3000 ft., is being extended to cut Gold King and Allemakee veins. Equipment of old Gray Eagle mill, 40 tons capacity, is being moved and erected to treat Cold Spring ore.

Eagle County

EASTERN STAR (Gilman)—D. G. White has tunneled for and found a large shoot of gold ore that was worked 30 years ago in an upper level.

Gilpin County

ARAPAHOE MILL (Black Hawk)—Remodeling of old Rocky Mountain concentrator progresses. A Denver quartz mill and an Isbell vanner will be installed.

Gunnison County

ABE LINCOLN (Pitkin)—There are 300 tons of ore in mine bins ready for hauling to mill.

Lake County

WESTERN ZINC MINING & REDUCING CO. (Leadville)—New smeltery is progressing well; expect to start in July.

TENDERFOOT (Leadville)—A cave-in recently interrupted production from some parts of mine but will soon be cleared.

WALKER TUNNEL (Leadville)—Bisbee, Ariz., men are interested in this project and developing ground in extreme western part of district on Mosquito range. Contract has been let to drive another 100 ft. of main adit by hand.

Ouray County

BARSTOW (Ouray)—Lessees report opening high-grade gold ore.

REVENUE (Ouray)—It is reported that British interests have negotiated for purchase of Revenue Tunnel, Wheel of Fortune, Monarch, Loyal and Cumberland properties.

Park County

HILL TOP (Fairplay)—Railroad service has been resumed and ore mined last fall has been shipped. Bins are kept filled.

Routt County

CAMP ACTYN IS A NEW CARNOTITE DISTRICT on Blue Mountain. Ground is being staked. Gold, silver, copper and zinc are also reported.

WILLOW CREEK, BEAVER CREEK AND WAY'S GULCH ALLUVIALS, amounting to 2000 acres, are to be drill prospected this summer with view of dredging next year.

San Miguel County

SUFFOLK (Ophir)—Michigan men will put in cyanide equipment to retreat mill tailings.

TOMBOY (Telluride)—Local interest is aroused over freighting a crusher part weighing 13,800 lb. from town to mill over steep mountain road. Erection of new cyanide mill has been delayed by blockage of railroad from Durango, preventing delivery of timbers.

MICHIGAN

Copper

SOUTH LAKE (Houghton)—Developments at third level on Evergreen lode at this property are showing satisfactory and those in close touch with property are optimistic regarding its ultimate success.

HANCOCK (Hancock)—Company is producing a little more than 250 tons of rock daily. All work is confined to No. 2 shaft and rock is coming from extension of levels; plan being to extend levels to limit of property and work back. Crosscuts are being extended into lode at various points, and property will be in shape to handle a large tonnage in near future.

FRANKLIN (Demmon)—Developments on Allouez conglomerate lode are proving encouraging. This work is being done at 32nd level and rock is being shipped to Allouez-Centennial mills. Formation is 15 ft. wide at this point and well mineralized throughout. This work together with a continuation of crosscut into foot wall is only work being done at property at present and no attempt has been made to resume operations in old workings, since strike.

Iron

STATE TAX COMMISSION—Valuation of mines in Iron River district has been reduced $2,000,000 under 1913 figures. Those in Stambaugh township received largest cut. Caspian was lowered $1,000,000, Baker & Tully $600,000. Zimmerman, Bengal, Youngs, Forbes, Davidson and Fogarty were raised slightly. Reductions have also been made in Ishpeming, Negaunee and Crystal Falls districts. Negaunee district was lowered $2,000,000, while $750,000 was taken off Ishpeming mines. There is no doubt that valuations placed on many of mines a few years ago were altogether too high and reductions were not unexpected.

ANVIL (Ironwood)—Newport Mining Co. has started to open north vein at Anvil mine, one of the largest deposits of iron ore on Gogebic range.

CHAPIN (Iron Mountain)—One of the new electric pumps at Hamilton shaft is now in operation and it is hoped to have entire plant in operation soon.

INDIANA (Iron Mountain)—Three carloads of machinery for this mine, which is being reopened by Thomas Furnace Co., were received recently from Baraboo, Wis. Consignment includes power plant, compressor and pumps. Work of installing it has already commenced. Considerable water will have to be pumped but it is believed equipment will be sufficient to take care of flow.

LAKE ANGELINE (Ishpeming)—W. G. Pollock, secretary-treasurer of Jones & Laughlin Co., has stated that mine will be closed and machinery removed Dec. 1, 1914. Mine has been one of the most famous producers in Michigan and has shipped 9,000,000 tons of high-grade hematite. It has been working for 40 years and some of the employees started work there shortly after mine was opened. An effort will be made by management to keep older hands on company's payroll and places will be found for many of them at Iron Mountain Lake property, where a shaft is now being sunk. There is some ore in stock and a little is being hoisted each day. Some shipments have been made and most of the ore will be sent out this season.

MINNESOTA

Cuyuna Range

GENERAL CUYUNA CONDITIONS—Announcement of beginning of mining operations on Jamison & Peacock deposit has in a measure dispelled the gloom. Entrance of new operators into district has had a stimulating effect. Armour No. 2 stockpile is now being shipped, and Cuyuna-Mille Lacs and Ironton shafts, now part of American Manganese Manufacturing Co.'s property, it is stated will ship upward of 200,000 tons before season closes, although but little tonnage has gone from these shafts to date. Continuous heavy rains have hindered railroad construction work, there being considerable of such work in progress and more planned. On South range, Adams continues to stockpile its product. Wilcox shaft, at Woodrow, is being sunk one foot per day; it is a timber drop-shaft. Sinking also continues at Brainerd-Cuyuna shaft at Brainerd. Pumps are still working in Barrows shaft, but no ore is being hoisted. No plans for future operation of the last mine have as yet been announced.

DULUTH-BRAINERD (Crosby)—Shaft has been bottomed at 150 ft. plus a 15-ft. sump. Station has been cut and drifting to orebody is in progress; it is 80 ft. distant, and should be encountered by July 4.

CUYUNA-SULTANA IRON CO. (Ironton)—Company is sinking a small exploratory shaft, now down nearly 60 ft. Some quisksand difficulties have been overcome and shaft should be bottomed in a few days. L. L. Culbertson, Duluth, is president, and A. R. McGuire, Duluth, consulting engineer. It is a stock company.

AMERICAN MANGANESE MANUFACTURING CO. (Duluth)—Arrangements are being made to list stock of company on New York and Boston exchanges. Newly elected board of directors is as follows: A. K. Dickson, Wm. Selfridge, E. E. Marshall, W. A. Powell and W. E. Arnold, of Philadelphia; E. J. W. Donahue and W. H. Locker, of Duluth; C. B. Rowley of Brainerd, Minn., and T. W. Stevenson, of Minneapolis. E. E. Marshall is president and general manager, and in charge of blast furnace operations; W. H. Locker, vice-president; E. J. W. Donahue, secretary and manager of mining department; W. E. Arnold, assistant secretary, and A. G. Dickson, general counsel.

MERRIMAC MINING CO. (Crosby)—Company has taken lease from Cuyuna Realty Co., Northern Pacific Ry. interests, on Jamison & Peacock 40-acre tract and 20 acres owned by Chisholm, Williams & Magoffin, of Duluth, adjoining. Both properties have been thoroughly drilled and contain highest-grade deposit of bessemer ore encountered in Lake Superior iron district for many years. Deposit runs diagonally across property for half a mile, and many drill samples taken assayed from 68% to 69.52 iron, with an average of 0.034% phosphorus for bessemer part of deposit. There is an inconsiderable tonnage of non-bessemer ore also. Property is almost within city limits of Crosby, and an exploration shaft is now being started, to be later used as a timber shaft, when a new steel shaft will be sunk. Surface averages 90 ft., and tonnage is variously estimated up to 3,000,000 tons. John A. Savage, Duluth, Minn., is president and treasurer and John A. Savage & Co. will conduct operations for Merrimac company. Savage was until recently general manager of mining department of Shenango Furnace Co. Ore will be hauled by Northern Pacific Ry.

Mesabi Range

IROQUOIS (Mountain Iron)—Mine is loading from stockpiles after idleness of several weeks. No ore has been hoisted for three months.

MONTANA

Deer Lodge County

ELK GOLD MINING CO. VS TOM BUCKLEY—This case, after having been in litigation for nearly two years has been settled out of court. According to terms of settlement, Buckley receives a life lease on surface while mining company is to go ahead with development work of mineral under an area covering 13 acres of Buckley's homestead entry. In last decision by land office officials, mining company was awarded right to mine on ground on which Buckley had filed a homestead entry.

Madison County

WYROUCK (Bear Gulch)—According to report of S. A. Jones, operations at these gold mines will be commenced at once.

Silver Bow County

TUOLUMNE (Butte)—Shaft has been sunk to depth of 2570 ft. and is going down at rate of 60 ft. per month. About 215 ft. of drifting on vein has been done on 2400-ft. level, this development showing much better results than similar work on 1800-, 2000- and 2200-ft. levels. Two cars of ore are being shipped daily, with enough ore blocked out to keep property going one year at this rate.

BUTTE & SUPERIOR (Butte)—Constant improvements in operation of company's mill have resulted in production during last few weeks, of a 54% zinc concentrate, this being equivalent to 93% extraction. These high-grade concentrates result in a considerable increase in company's earnings due to fact that smelters pay a premium for each unit in excess of 50% zinc in concentrates.

EAST BUTTE COPPER MINING CO. (Butte)—At reduction works of this company, experiments are being carried on with retreatment of fine-slime tailings by flotation. These tailings carry 1.2% copper, 75% of which is expected can be recovered by flotation at a cost of 50c. to $1 per ton. There are between 50,000 and 100,000 tons of these tailings on dump and 200 tons of fresh tailings are made daily. Copper in coarser tailings is too low to pay for regrinding and treatment.

RAVEN COPPER CO. (Butte)—It is reported that proposed sale of company's property in Butte, is being opposed by certain stockholders who claim that mine is being disposed of at a ridiculous figure. These stockholders endeavor to secure investigation of management and prevent a disadvantageous sale of property which in opinion of certain men is valuable,

being surrounded on all side by great copper producers. After a short brilliant career, mine was operated for years without profit and was finally closed down six months ago.

TIMBER BUTTE CONCENTRATING CO. (Butte)—Mill of this company, on northern slope of Timber Butte was built to treat zinc ores from W. A. Clark's Elm Orlu mine which adjoins Butte & Superior's Black Rock mine. Process of treatment is similar to that developed in Butte & Superior mill. It consists of two-stage table concentration and flotation and retreatment of lead-zinc-iron middlings on tables and jigs. Latter treatment will yield zinc concentrate and also a lead-iron concentrate. Coarse flotation concentrates will be retreated on tables for same purpose of taking out lead and iron and enrich zinc product. Zinc concentrates will be shipped to Bartlesville, Okla., smelters. Plant was built in accordance with plans developed during a long series of experiments and results of a recent mill run agree closely with those expected, viz.: zinc 20%, silver 7 to 8 oz., copper 8%, lead 1½%, iron 2½%, gold 20 to 80c. Mill was in operation at beginning of month. Present capacity is 400 tons per day.

NORTH BUTTE (Butte)—According to company's report filed June 9 with county assessor net earnings for year ended June 1, amounted to $1,294,006, showing a decrease of $300,000 from last year. Decrease is due chiefly to low price for copper, also to fact that average grade of ore extracted and treated was lower than that of ore treated in preceding year. Total ore mined was 463,438, of a gross value of $10.83 per ton. Cost of extraction per ton was $3.95; cost of transportation to smelter $0.13; actual cost of reduction or sale per ton $3.85. According to latest reports physical condition of mines is highly satisfactory. Development work has proved nearly 1,000,000 tons of ore ahead of production. Snowball vein is leading producer and is also responsible for nearly half of tonnage of ore blocked out, Adirondack and Edith May veins furnishing other half. Jessie vein which with Edith May furnished North Butte big bonanza shoots in upper levels, proved disappointing in levels below the 2000, but will probably be further explored on 2600-ft. level. Management has also under consideration exploration of new ground north of Snowball vein toward Berlin vein which shows indications of good ore on surface.

NEVADA

Elko County

COPPER STRIKE SOUTH OF BULLION has been made. Ore is low-grade and contains gold and silver. There was a rush to discovery and over 100 claims have been staked.

ACTIVITY IN DOLLY VARDEN DISTRICT near Currie, P. O., is evident. Several copper discoveries have been made and prospecting is being done by shaft sinking and with power boring machines.

Esmeralda County

FLORENCE (Goldfield)—Good tonnage of ore is being stoped from Florence vein in south drift on 100-ft. level. Stoping on 50-ft. level in north drift is also being done. Main north drift on 530-ft. level is being driven in recently discovered downward extension of Wheeler lease vein.

Humboldt County

FIRST SHIPMENT FROM HAYSTACK has been made. Ore was mined from surface on Smith property. Five leases have been let.

OKLAHOMA MINING CO.—Work at this property in Pine Forest range has been temporarily suspended on account of a pending deal. It is stated that Tonopah Mining Co. has a corps of engineers in the field, examining various properties in this district.

Lander County

NEW CAMP OF McCOY has sprung up at scene of gold discovery. McCoy is 30 miles southwest of Battle Mountain and is above Gillman Troughs, approach being from Reese River side.

AUSTIN-NEVADA (Austin)—Gasoline-engine driven compressor is being installed. Machine drills will be used in further driving of main tunnel. Main oreshoot, it is expected, will be cut within 150 ft.

Lyon County

NEVADA WONDER GROUP (Yerington)—Whim is being installed at this property east of Yerington, and shaft will be sunk another 100 ft.

GOLD PEBBLE (Smith Valley)—Crosscut tunnel is being driven to cut vein which has been opened on surface for length of 600 ft. When vein is cut, sinking will be started.

NEVADA-DOUGLAS (Ludwig)—Development work in Casting Copper and Ludwig mines is progressing with satisfactory results. It is stated that construction of leaching plant will commence in near future.

Mineral County

IROQUOIS COPPER CO. (Luning)—Development work is progressing with satisfactory results. Eight cars of ore have been shipped so far this year, or enough to defray expenses. This ore is said to assay $2 in silver per ton in addition to copper. Stoping is being done above main tunnel, and a crosscut tunnel is being driven to prospect more ground.

Nye County

SPANISH BELT (Manhattan)—Pump will be installed at this property between Manhattan and Belmont, and mine workings will be unwatered. This mine was a large producer in past, but was closed on account of water.

MUSHETT-WITTENBERG LEASE (Manhattan)—It is stated that one miner working in glory hole with a Jackhamer drill, breaks sufficient ore to supply 125-ton mill. New oreshoot has been developed north and west of shaft.

PIONEER CONSOLIDATED MINING CO. (Pioneer)—Oreshoot assaying $7 per ton has been struck in raise from northwest drift on 265-ft. level, and stoping is now being done. Sufficient development work has not yet been done to determine whether this shoot is in main vein or a parallel vein. A Huntington mill for regrinding has been installed in milling plant and a larger tonnage is now being treated and a better extraction made. Tailings from high-grade ores are being treated in cyanide plant, and low-grade ore tailings are being impounded for future treatment.

Storey County

YELLOW JACKET (Virginia City)—Cyanide plant is being added to milling plant.

CONSOLIDATED PUMPING ASSOCIATION (Virginia City)—Changes, in accordance with recommendations of arbitration committee, are being made to improve ventilation on 2500-ft. level of Consolidated Virginia. Compressed-air line between C. & C. shaft and Consolidated Virginia winze is also being repaired.

SIERRA NEVADA (Virginia City)—Winze below 2500-ft. level is still being sunk in ore. Shoot consisting of 6 ft. of low-grade ore and 21 in. of high grade is exposed. One car of high grade assayed $150 per ton. Repairs have been made to Union shaft; this was done jointly with Union Consolidated and Mexican.

White Pine County

WILLOW CREEK GOLD MINES CO. (Willow Creek)—High-grade gold ore it is stated, has been discovered in new winze.

STEPTOE VALLEY SMELTING CO. (McGill)—Experimental oil-flotation plant has been erected and will be in operation soon. It is stated that plant will have capacity of 100 tons of slimes per day.

NEW MEXICO

Colfax County

BLACK COPPER CO. (Red River)—Unwatering is under way preparatory to examination.

GOLDEN TREASURE MINING CO. (Red River)—Steam-power plant will be installed and a new shaft raised from bottom level of incline.

Grant County

CARLISLE (Steeplerock)—G. H. Utter has commenced work on Summit group after building new road. Work will also be resumed on Jim Crow mine.

CHINO COPPER CO. (Santa Rita)—Work is progressing rapidly on ore-crushing plant. Steel and cement work are now under way and ore bins are being erected. Many improvements are being made on roads into camp. Railroad bridge has been built for outlet from Northwest orebody to crushing plant. Power for crusher will be transmitted from Hurley.

Luna County

MAHONEY MINE (Deming)—Shipments of high-grade zinc-carbonate ore have been made to smelter. Property is one of the oldest producers in Florida mountains.

Socorro County

DISCOVERY IN MOGOLLON DISTRICT of petzite ore is described as follows: Recent discovery at head of Rain Creek was made in a region that while not remote is extremely rugged, and it was only by accident that vein was discovered in February by Jack Alexander, who had been snowbound in mountains and took an unusual route out, taking him across backbone of range. Here at a height of almost 10,000 ft. discovery was made. Theodore W. Carter has secured a bond on original claims from owners, Jack and Floyd Alexander and Lee Meader. Outcropping of ore is 10 ft. wide on average and is exposed for a distance of 2000 ft., the lowest exposure being at least 1000 ft. below apex. Surface assays show $8.35, two-thirds of which is gold and one-third silver. Ore is petzite, and is susceptible to treatment by cyanide. Vein lies between walls of porphyry and rhyolite, differing in this respect from formation in Mogollon, where both walls are porphyry. New camp is in one of the most beautiful sections of Mogollon country. It is heavily wooded and has an abundance of water so that water power can be developed. An automobile can be driven to within three miles of Lone Star, which was original discovery, but remaining three miles is steep and rough. By lengthening distance to six miles a good wagon road can be built, even at that it will be more accessible than Mogollon and is considerably nearer to Silver City. A large number of claims have already been taken up. John Hightower has the most sensational. He claims to have telluride ore on his property and, as it characteristic of this ore, gold can be melted out of it in a camp fire. This discovery is 2½ miles north of the Lone Star.

Taos County

CHAMPION COPPER CO. (Copper Hill)—Judgment has been given to plaintiff for $12,590 in case of Champion Copper Co. vs. Champion Copper Co., different companies, in court at Santa Fé. An order has been entered to sell property of company at Copper Hill, including pipe line, administration building, homes for workmen, tools and equipment. Richard J. Burton, of Boston, representing company, declares work will be resumed shortly on extensive scale.

NEW YORK

Essex County

McINTYRE IRON CO. (Port Henry)—This company which leases furnaces of Northern Iron Co., has been for some time experimenting with Adirondack ores carrying from 12 to 14% titanium oxide. Proportion of titaniferous ores in burden has been gradually increased from 6¼% up to 25%; at last accounts furnace was still using higher proportion and was running smoothly, making a high-grade foundry iron.

WITHERBEE-SHERMAN & CO. (Mineville)—Mills Nos. 1 and 2, the smaller and older of four plants operated by company, together with cobbing plant adjoining, were destroyed June 17 by fire that started in conveyor-belt passageway, and which probably was caused by some disorder in extensive electrical equipment. Plants were of frame construction; loss was fully covered by insurance. A new mill will be built, following type of mills Nos. 3 or 4, fireproof construction, and of capacity to equal that of plants destroyed. Meanwhile by working double shifts in No. 3, no loss of total milling capacity will be suffered.

OREGON

Josephine County

WORK ON MUNICIPAL RAILROAD being built by city of Grants Pass and which will tap many undeveloped mines, is progressing rapidly. Money from sale of bonds is available now and rails and equipment are being purchased and track laying will soon begin. At a meeting of public-utility commission a committee was appointed to buy or negotiate for box and flat cars for use on road. Railroad bridges are being constructed and all other work rushed and it is expected to have 10-mile stretch of road completed and hauling ore and timber by fall.

ORIOLE (Galice)—The 10-stamp mill recently built has commenced operations. It is expected that 30 tons of ore will be milled daily. Ore from this mine was shipped to Tacoma for smelting for several years and enough money realized in that way to build mill.

SOUTH DAKOTA

Lawrence County

RATTLESNAKE JACK (Galena)—Trent cyaniding machinery will be used in this new mill now under construction. Following crushing to six-mesh under 10 stamps, fine grinding will be done in a Hardinge conical mill operated in closed circuit with a Dorr classifier. Trent equipment will include a thickener and agitator, each 16x24 ft., and two replacers, 14x24 ft. Zinc-dust precipitation, by Merrill process, will be followed, using a 200-ton press.

MOGUL (Terry)—After a three-months' run this mill is getting into good running shape, and is particularly interesting by reason of inaugurating for Black Hills a new system of cyanidation. All ore is slimed, using a 5x18-ft. tube mill operated in closed circuit with a Dorr duplex classifier. A No. 5D Gates crusher, 14x36-in. rolls and a 6-ft. chilean mill prepare ore for tube mill. Following fine grinding slime is treated by agitation and continuous decantation, in first, a 35x10-ft. tank equipped with Dorr thickener, then through two 15 ft. 6 in. by 16 ft. Dorr agitators, then through four 25x10-ft. tanks equipped with Dorr thickeners. At the third of these barren solution is added, and at the fourth, wash water, and the thickened slime discharged from it as final tailings. Only solution for precipitation overflows from 35-ft. thickener, and is drawn through a clarifying filter before going to zinc boxes. Chilean mill, tube mill, elevator, classifier, thickeners, pumps and two 10x10 compressors are driven by a 130-hp. De La Vergne oil engine. Thickened slime is handled throughout plant, except where it flows by gravity, by diaphragm pumps. Capacity of plant is 150 tons daily.

TENNESSEE

Polk County

DUCKTOWN SULPHUR, IRON & COPPER CO. (Isabella)—Breaker house, bunkers and hoists at East Tennessee mine were burned June 10. Engine of breaker house was also badly damaged, but it can be repaired. Origin of fire is at yet only conjecture, as it caught in the breaker which was in flames when discovered. Timbers being long seasoned and dry, burned rapidly and soon fell to bunkers, which caught and burned, making all efforts to combat the flames futile. Loss is not covered by insurance. One great cause of delay in rebuilding is that all timbers will have to be ordered sawed, as there are none in stock of heaviness and size demanded. Tennessee Copper Co. promptly proffered the use of any material that it might have in stock in reërecting of new plant.

UTAH

Juab County

TINTIC SHIPMENTS for week ended June 5 amounted to 126 cars; and those for week ended June 12, to 148 cars, from 21 shipping properties. An effort may be made by companies on east side of camp to induce railroad to build a spur four miles long. This would serve Tintic Standard, Grutli, Noon, Eureka Lily and Provo properties.

VICTORIA (Eureka)—This mine was shut down for two days, owing to an accident to sheave wheel.

KNIGHT MILL (Silver City)—Mill is being operated two-thirds of the time. A run of 130 hr. was made recently, after which a shutdown was necessary to make adjustments.

CHIEF CONSOLIDATED (Eureka)—A right-of-way has been secured from Victoria across a piece of ground needed in construction of a side track to connect with Denver & Rio Grande.

IRON BLOSSOM (Silver City)—Ore is reported to have been followed 200 ft. on 400 level, and new east vein has been cut on 600. Considerable development has been done in south end of property.

Summit County

PARK CITY SHIPMENTS for week ended June 5, were 2,704,340 lb. by Daly-Judge, Silver King, Coalition, Silver King Consolidated, and Daly West; for week ended June 12 shipments amounted to 2,674,000 pounds.

SNAKE CREEK TUNNEL (Park City)—Tunnel is entering mineralized ground; first stringer of galena was cut recently.

SILVER KING CONSOLIDATED (Park City)—In accordance with decision to place company on a regular dividend paying basis, a quarterly payment of 10c. per share or $62,000 will be made July 1. This will bring total of dividends thus far to $433,000. Since opening of roads, 700 tons of ore have been shipped. Connections are nearly completed between 1550 and 1700-ft. levels.

GRASSELLI MILL (Park City)—Work of remodeling old mill for a custom plant for district is in progress. It is expected that changes will have been completed by end of July. Capacity will be 50 tons per day. Building has been somewhat enlarged to accommodate crushers, and outside building bins for ore fuel, salt, etc., have been completed. Tanks, shafting, etc., are in place., and electric equipment is being installed. Crushers have been shipped.

CANADA

British Columbia

CHAHKO MIKA CELEBRATION committee in connection with a carnival to be held at Nelson from July 13 to 18, has decided to offer $1000 for a machine-drilling contest in that city, and arrangements have been made for use of a compressor and power for this contest.

MOTHERLODE SHEEP CREEK MINING CO.—The 10-stamp Merrill mill is again in operation, after three months' inactivity. Work was done at mine all through winter, so that there are now 6000 tons of ore available for crushing.

GRANBY CONSOLIDATED (Phœnix)—Mining is to be done on a more extensive scale. Latest equipment added is a Bucyrus electric shovel. Mine is to be again worked to a large extent by glory-hole process. New shovel can load a 10-ton car in three minutes, and it is capable of handling 1500 yd. of loose ground in 10 hr. It has a dipper capacity of 2 cu.yd. and can lift 10 or 12 tons. Machine weighs 50 tons.

Ontario

McINTYRE (Schumacher)—Company will use Dorr continuous decantation cyanide process.

THREE NATIONS (Porcupine)—Most of the miners have been laid off pending a mill test of ore.

VIPOND (Schumacher)—Mill construction is proceeding rapidly; concrete work has been completed. Underground work will be recommenced in a few days. Plant will be for continuous decantation.

BAILEY (Cobalt)—This company is to be liquidated. A meeting of creditors will be held June 30 in Toronto. E. F. Benson, president of company and majority stockholders have advanced large sums for development during last three years.

DOME (South Porcupine)—Statement for May shows 16,180 tons milled and $62,109 recovered. Mill ran 90% of time; 80 stamps are now dropping, but as addition is not fully completed, tonnage for June will not show any large increase.

TECK-HUGHES (Swastika)—Company has laid off most of its miners. It is understood to be short of funds. A discovery of exceedingly rich ore, similar to that on the Tough-Oakes, was reported in vicinity of Sesekinika Station, three miles north of Swastika.

CANADIAN GOLD FIELDS (Toronto)—This company's assets consist of stock in Consolidated Mining & Smelting Co. It will distribute stock among shareholders on basis of one share of Consolidated for 1500 shares of Goldfields. After this distribution, there will be 270 shares of Consolidated M. & S. stock left; this will be sold for cash and proceeds distributed.

HOLLINGER (Timmins)—Stock is strong, due to rumor that Acme will shortly be taken over as part of Hollinger company. The 28-day report ended May 19, shows gross profits of $123,087. Total cost per ton was reduced to $4.22, while grade was somewhat lower than $13.10. Mill ran 94% of possible running time and treated 15,200 tons, of which 831 came from Acme. Extraction was 95.7%. Surplus now stands at $820,058.

Yukon Territory

YUKON GOLD CO.—Report of May 15 states: All dredges in Klondike camp are under operation with exception of No. 1 at mouth of Bonanza, which is waiting for high water there to subside, and No. 6, on Gold Run, which is not quite assembled. First boats to start were Nos. 3 and 8, May 11. Nos. 5 and 9 started May 13, Nos. 2 and 4 May 14. No. 1 was to be running soon and No. 6 to be ready June 1. Hull of No. 6 was floated May 1. It will work on No. 12 Gold Run, a famous old producer in the days when Chute & Willis operated the ground with a large crew of men working by hand methods. Of company's dredges now operating, one is on Eldorado, one on Bonanza, one on 41 Hunker and others on Lower Bonanza. Hydraulic plants are also getting under way. Fox gulch giants began May 8 and Lovett gulch started May 9. The Twelve Mile ditch is carrying 3500 miner's inches or more of water. Twelve Mile power house started up May 9. Power from plant is not only being transmitted to company's dredges on this side of divide, but also to No. 6 on Gold Run. It has its own power line to Gold Run.

SWEDEN

UTILIZATION OF ALUM SHALES will be studied by a commission of three experts appointed last year by Swedish government. Commission has obtained control of a deposit of shale near Gossatar, and will carry on exhaustive experiments in its distillation, to determine whether it can be made commercially profitable.

BRAZIL

DIAMOND KING MINING CO. (Diamentina, Minas Geraes)—Company is reputed to have a 30-year concession to 20,000 acres of land. At present drill tests are being made on river concessions. Preliminary tests taken recently on 20 acres of river concessions show 65c. gold.

COSTA RICA

ABANGAREZ GOLDFIELDS (17 Battery Place, New York)—Workmen seized properties recently and operated them for their own account. A shutdown was ordered a few days ago because gold was being stolen by miners. It was decided to stop work until a better system of checking output could be devised; 600 workmen were thrown out of employment unexpectedly and many of them faced starvation. As there is no other industry near mines which could absorb men out of work they decided to continue working mines, declaring that properties belonged to them as natives of country rather than to foreigners who refused to work them. Local authorities in district acknowledged that they were unable to cope with situation and president ordered a company of regulars to entrain.

TRANSVAAL

MESSINA-TRANSVAAL DEVELOPMENT CO.—It is announced that company has been seriously affected by suspension of Canadian Agency and of Chaplin, Milne, Grenfell & Co.

The Market Report

METAL MARKETS

NEW YORK—June 24

The metal markets are still inclined to be slow and inactive. Prices show only small changes, but are not advancing.

Copper, Tin, Lead and Zinc

Copper—Right from the beginning of the week electrolytic copper was offered from all quarters at 13¾c., delivered, usual terms, and some small sales were made at that price, both for domestic and foreign delivery. The orders taken, however, are far less than the current production, with the natural result that stocks are increasing. The statistical position is not yet materially impaired, and if a carrying of the stocks pro rata could be arranged, the market would be stiffer; but that is against the law, and agencies that are taking in copper and producers that are turning it out need to sell it, with the result that whenever the big interests reduce their asking price, somebody else immediately shades it. On June 22-23, sales were made on the basis of about 13.55c., net cash, New York. On June 24, certain of the larger interests were reported to be offering openly at 13.67c., delivered in Europe, while from other quarters the metal was quite freely offered at 13⅝c., delivered, usual terms.

The average of electrolytic copper quotations for the last week is 13.567 cents.

Lake copper has been offered during the last week on the basis of 13.90c., New York, even in carload lots, without finding buyers.

The London market for standard copper has been quiet and weakish, spot on Thursday, June 18 being quoted £61 11s. 3d., and three months £62 3s. 9d. The market closes at £60 18s. 9d. for spot and £61 11s. 3d. for three months.

Base price of copper sheets is now 19c. per lb. for hot rolled and 20c. for cold rolled. The usual extras are charged and higher prices for small quantities. Copper wire is 14⅞@ 15½c. per lb., carload lots at mill.

Copper exports from New York for the week were 10,039 long tons. Our special correspondent reports exports from Baltimore for the week at 5086 tons.

Tin—The market, while extremely dull, has displayed hardening tendencies. The Far East has been a reluctant seller and thereby influenced the bears in the London market to such an extent that there operations have been suspended for the time being. Consumers in this country did not show much interest in futures and confined their purchases to spot material, which has become rather scarce and for which a premium was asked. The market closed somewhat easier at £139 2s. 6d. for spot and £140 17s. 6d. for three months, and about 30⅝c. for June-July tin here.

Lead—The card price of the largest interest for desilvered lead remains at 3.82½c., St. Louis, but the larger part of the outside lead sold during the last week appears to have been at about 3.80c. During the last day or two, some carload lots have gone at 3.77½c., St. Louis. Without taking these into account in quoting the market they may, perhaps, reflect a slightly weaker tendency.

The London market is quiet, Spanish lead being quoted £19 7s. 6d. and English lead 2s. 6d. higher.

Exports from Baltimore for the week included 448,373 lb. lead to Hamburg, Germany.

Spelter—Business in this metal has been stagnant. Some interests reported offering to sell at 4.90c., and unable to consummate business, which is natural enough inasmuch as there had been free offers from other quarters at 4.85c. The largest consumer is reported to be talking about 4.75c., as if it might possibly be an interesting price. It is not difficult to explain the situation in the spelter market. Demand is light, production is large, and stocks on hand are large and increasing. Four of the largest smelting interests today gave us their guesses of the present stock. One guessed 60,000 tons; another, 45,000; another, 40,000; and the fourth, 50,000. Our own guess is about 50,000. At the beginning of 1914, the stock was about 40,000. While none of the larger producing interests evinces any disposition to slash prices, nevertheless, nobody would hesitate about shading a few points to book an order of consequence. The unsold stock in Europe is also very large, but since the beginning of May, when it was understood to be upward of 80,000 long tons, it probably has been diminishing in view of the curtailment inaugurated by the terms of the convention.

The London market is quiet, good ordinaries being quoted £21 5s. and specials £22 per ton.

According to telegraphic dispatches from Butte, the new mill of the Timber Butte Milling Co. has been put in operation without a hitch and is already turning out a good quality of blende concentrate.

Base price of zinc sheets is now $7 per 100 lb., f.o.b. Peru, Ill., less 8% discount, with the usual extras.

DAILY PRICES OF METALS

NEW YORK

June	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc	
			Electrolytic, Cts. per Lb.	Cts. per Lb.	New York, Cts. per Lb.	St. Louis Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.
18	4.8835	56⅜	13.55 @13.65	30⅛	3.90	3.80 @3.82½	4.97½ @5.00	4.82½ @4.85
19	4.8800	55⅞	13.55 @13.65	30½	3.90	3.80 @3.82½	4.97½ @5.00	4.82½ @4.85
20	4.8795	56⅛	13.55 @13.65	30½	3.90	3.80 @3.82½	4.97½ @5.00	4.82½ @4.85
22	4.8800	56½	13.50 @13.60	30⅜	3.90	3.80 @3.82½	4.97½ @5.00	4.82½ @4.85
23	4.8815	56⅜	13.50 @13.60	30¾	3.90	3.80 @3.82½	4.97½ @5.00	4.82½ @4.85
24	4.8810	56¼	13.45 @13.55	30⅜	3.90	3.80 @3.82½	4.97½ @5.00	4.82½ @4.85

The quotations herein given are our appraisal of the markets for copper, lead spelter and tin based on wholesale contracts; and represent, to the best of our judgment, the prevailing values of the metals specified as indicated by sales by producers and agencies, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.15c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumer. To reduce to New York basis we deduct an average of 0.15c. representing delivery charges. The price of electrolytic cathodes is usually 0.05 to 0.10c. below that of electrolytic; of casting copper 0.15 to 0.25c. below. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Western brands. Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb., are: St. Louis-New York, 15½c.; St. Louis-Chicago, 6c.; St. Louis-Pittsburgh, 12½c.; New York-Bremen or Rotterdam, 15c.; New York-Havre, 16@ 17½c.; New York-London, 16c.; New York-Hamburg, 18c.; New York-Triests, 22c.

LONDON

June	Silver	Copper				Tin		Lead		Zinc	
		Spot		3 Mos.	Best Sel'td	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
		£ per Ton	Cts. per Lb.								
18	25⅞	61 5/16	13.38	62 5/16	66½	138	139½	19½	4.24	21½	4.62
19	25 11/16	61⅜	13.33	62	66	137½	139¼	19½	4.24	21½	4.62
20	25 11/16	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
22	26	61	13.25	61⅜	65¼	138⅜	140⅛	19⅜	4.21	21⅜	4.64
23	25 11/16	61	13.25	61 5/16	65¼	139⅜	141⅛	19⅜	4.21	21½	4.62
24	25⅞	60 11/16	13.24	61 5/16	65¼	139⅛	140⅞	19⅜	4.21	21½	4.62

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latte being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26¼c. = £25 = 5.44c.; £70 = 15.22c. Variations, £1 = 0.21¾c.

Other Metals

Aluminum—The market has been quiet and sales have been on rather a small scale. The market is unchanged at 17½@18c. per lb. for No. 1 ingots, New York.

Antimony—Business is quiet and buying on a moderate scale. Ordinary brands—Chinese, Hungarian, etc., are slightly easier, at 5.65@5.90c. per lb. Cookson's is quoted at 7.15@7.35c. per lb.; for other special brands 6.90@7c. is asked.

Quicksilver—Business is better and the market is firmer, though there has been no actual change in prices. New York quotation is $37.50@38.50 per flask of 75 lb.; with 54@55c. per lb. quoted for jobbing lots. San Francisco, $37 per flask, with about $2 less quoted for export business. London, £7 per flask, with £6 17s. 6d. quoted from second hands.

Nickel—Quotations for ordinary forms—shot, blocks, or plaquettes—are 40@45c. per lb., according to size of order and quality. Electrolytic nickel is 5c. per lb. higher.

Minor Metals—Quotations for **Bismuth** are $1.80 per lb. for imported, $1.72 for metal from native ores—**Cadmium**, 750 marks per 100 kg.—81c. per lb.—at works in Germany—**Magnesium**, $1.50 per lb., New York—**Selenium**, $3@3.25 per lb. for lots of 100 lb. or over, and $5 per lb. for small quantities.

Exports from Baltimore for the week included 2220 lb. selenium to Hamburg.

Gold, Silver and Platinum

Gold—No premiums were paid this week on the open market in London, the price remaining 77s. 9d. per oz. for bars. The outward movement from New York to Paris continues, $10,500,000 having been taken for export this week, in addition to all that was sent last week.

Export demands have made necessary the transfer of $43,000,000 in gold to New York within a week. One shipment consisted of $25,000,000 gold bars from the Denver Mint.

Platinum—The market here remains rather quiet but steady and unchanged. Dealers ask $43@44 per oz. for refined platinum, and $46@51 per oz., according to quality, for hard metal.

Our Russian correspondent writes under date of June 10 that the market is strong and prices unchanged. The demand for small lots is good. Quotations are 9.65 rubles per zolotnik at Ekaterinburg, for crude metal, 83% platinum; at St. Petersburg, 37,100@37,200 rubles per pood for the same grade, equal to $36.28 and $36.41 per oz., respectively. The new regulations announced for the platinum industry have so far had no influence on the trade.

Iridium—Demand continues good and the price holds at $76@79 per oz., New York.

Silver—The market ruled dull and lower the first part of the week on China selling touching 25½d., but reacted on buying by the Indian Bazaars and rose to 26d. Market closes dull and quiet at 25⅞d., with tendency uncertain.

Shipments of silver from London to the East, Jan. 1 to June 11, as reported by Messrs. Pixley & Abell:

	1913	1914	Changes
India	£3,423,000	£3,528,000	I. £105,000
China	309,500	40,000	D. 269,500
Total	£3,732,500	£3,568,000	D. £164,500

Net imports of gold into India are reported at £1,231,000 in May.

Movement of Gold and Silver in the United States, five months ended May 31, as reported by the Bureau of Statistics, Department of Commerce:

	Gold		Silver	
	1913	1914	1913	1914
Exports	$63,165,292	$35,868,171	$28,590,221	$20,870,383
Imports	24,522,621	26,926,310	15,766,509	10,768,159
Excess	$38,642,671	$8,941,861	$12,823,712	$10,102,224

Merchandise exports for the five months this year were valued at $889,688,755; imports at $822,876,165; excess of exports, $66,812,590. Adding excess of exports of gold and silver gives $85,856,675 in the total export balance. This statement does not include the heavy gold exports in June.

Zinc and Lead Ore Markets

JOPLIN, MO., June 20

Blende sold as high as $44, the assay base being $39@41 per ton of 60% zinc. The metal base range was $38.50@39.50. Calamine sold strong at $22@23 per ton of 40% zinc. The average of all grades of zinc is $39.38 per ton. Lead sold at $47.50 on a base price of $46 per ton of 80% emtal content, and the average of all grades is $46.36 per ton.

Upward of 1000 men have left the mining district to follow the harvests in Western Kansas, Nebraska and on up into Dakota, and there is hardly a mine in the district that is not short of laborers; some have only half the shovelers needed. This will cause a decrease in output. It is estimated tonight that this week's output was not over 5000 tons and that next week will show not to exceed 4700 tons, or 25% decrease.

SHIPMENTS WEEK ENDED JUNE 29

	Blende	Calamine	Lead	Values
Totals this week ..	10,107,180	605,020	1,474,610	$245,080
Totals this year ...	259,744,000	17,647,460	44,907,400	$6,367,465

Blende value, the week, $203,770; 25 weeks, $5,085,960.
Calamine value, the week, 7240; 25 weeks, $201,235.
Lead value, the week, $34,070; 25 weeks, $1,080,275.

IRON TRADE REVIEW

NEW YORK—June 24

Orders in the iron trade are coming in a little more freely, and the general feeling seems to be improving, with a more hopeful outlook for the near future.

The general opinion is that June orders will be fully up to deliveries, if they do not exceed them. The general disposition among buyers is not to contract for material far ahead, but they are taking larger quantities for early delivery. Prices remain low, and mills are not anxious to take orders too far ahead at the present level.

The St. Louis & San Francisco has ordered 32,000 tons of rails, which are to be rolled at Ensley, Ala.; several smaller orders for rails are reported, and export orders for 25,000 tons are under negotiation. Structural steel is more active than it has been, with many small orders.

Pig iron is a little more active and there is a fair demand for both basic and foundry pig. Pipe makers are busy and have taken some good lots of Southern iron.

PITTSBURGH—June 23

The improvement over May in the rate of buying of steel products observed earlier in the month is still in evidence. Bookings of bars, plates, shapes, tubular goods and sheets show average increases of 40 to 50% in this month up to date compared with the corresponding period in May, which was the worst month of the year. The bookings referred to are all in concrete orders, with specifications furnished. Apart from such bookings there is more contracting for forward delivery. There is not a great deal of such business as yet, however, since buyers wish to be given protection at the current low prices made on prompt material, while the mills demand advances of $1 to $2 a ton for third quarter, and still greater advances for fourth quarter.

The steel trade has not been thrown into any optimistic mood by the improvement in actual business. It is to be observed that a movement like this, coming after a period of extremely light buying and when all stocks are at the lowest possible ebb, could run out overnight. On the other hand, the soundest and most important movement toward improvement could hardly show a beginning different from what has occurred in the past few weeks.

Steel prices are stationary and it is generally admitted had gotten about as low as they could get. The issue between buyer and seller now is not as to prompt prices, but as to how near the prompt prices business for forward delivery can be done.

The steel mills are operating on an average at fully 60% of capacity and on the whole are probably doing slightly better than in May. The heavier buying of late does not require much if any increase in output as deliveries are strung into July. It is now established that the mills will run better in July than was expected 30 days ago.

Plates, shapes and bars are 1.10c. for prompt shipment on desirable orders; black sheets are 1.80c. and galvanized sheets 2.75c. For delivery over third quarter quotations are $1 higher on plates, shapes and bars, while sheets are $1 to $2 higher.

Pig Iron—The market is far from active, but it is not as dead as it was in April. With nearly all buyers uncovered for third quarter, except for such tonnages as they carry over from second quarter, however, the market should now be much more active. Prices are resisting decline very well and have been practically stationary for several weeks. We quote: Bessemer, $14; basic, $13; No. 2 foundry, $13; forge, $12.50; malleable, $13, at Valley furnaces, 90c. higher delivered Pittsburgh.

Ferromanganese—The market remains very quiet, but steady at the regular figure of $38, Baltimore, with $2.16 freight to Pittsburgh.

Steel—There is no activity yet in contracts for third quarter. The Carnegie Steel Co. has a number of sheet bar contracts on which it will submit a price on June 25, for acceptance or rejection as to July or third-quarter shipments, and the announcement of this price may throw some light on the situation. Meanwhile the market is quotable nominally at $19.50 for billets and $20.50 for sheet bars. Rods are quiet at about $26, Pittsburgh.

IRON ORE

The first considerable sale of Lake ore to an Eastern furnace this season has been closed. The Alan Wood Iron & Steel Co. has bought a round lot for its furnaces at Swedeland, Penn. Presumably this buying is to make up for the deficit in the Venezuelan ore for which the company had contracted.

Imports of Iron Ore in Great Britain five months ended May 31 were 3,226,948 tons in 1913, and 2,441,975 in 1914; a decrease of 784,973 tons. Imports of manganese ore were 298,455 tons in 1913, and 205,217 in 1914; a decrease of 93,238 tons.

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 259,615 short tons; shipments, 253,352 tons. Production in the Greensburg and Upper Connellsville districts was 33,392 tons.

Connellsville Coke—A very interesting development is that one of the leading producers has closed two furnace coke contracts totalling 18,000 tons a month over the second half of the year at $2 at ovens, this being the maximum price lately asked. One of the buyers is in the West, the other being in the East. The latter has taken a smaller block of Greensburg district coke, which it gets at 20c. less at ovens, and upon which the freight is 20c. less than the Connellsville rate, so that its average cost of coke will be equivalent to a little above $1.85 at Connellsville ovens. There is coke offered on contract at less than $2, but little if any of it is high grade. Good coke is offered at much less for prompt shipment, down to $1.75, while $1.80@1.85 might be done for July. Foundry coke is moving slowly, considering that so many contracts expire this month. The regular price is $2.50, but this figure is sometimes shaded slightly on good brands, and quite considerably on indifferent brands.

Coal and Coke Tonnage Pennsylvania R.R. lines east of Pittsburgh and Erie five months ended May 31, in short tons:

	1913	1914	Changes
Anthracite	4,641,994	4,799,030	I. 157,036
Bituminous	20,092,450	19,657,638	D. 434,812
Coke	6,225,387	4,434,422	D.1,790,965
Total	30,959,831	28,891,090	D.2,068,741

The total decrease this year was 6.7%. The loss was chiefly in the tonnage of coke.

SAULT STE. MARIE CANAL

Total freight passing through the Sault Ste. Marie canals for the season to June 1 was: East bound, 5,505,160; west bound, 2,757,476; total, 8,262,636 short tons, a decrease of 5,019,114 tons from last year. The number of vessel passages was 2990, showing an average cargo of 2763 tons. The mineral freights included in the totals were, in short tons, except salt, which is in barrels:

	1913	1914	Changes
Coal	3,516,948	2,479,939	D. 1,037,009
Iron ore	7,308,544	3,765,607	D. 3,542,937
Pig and refd. iron	89,548	71,054	D. 18,494
Copper	18,910	9,169	D. 9,741
Salt, bbl.	181,095	266,133	I. 85,038

CHEMICALS

NEW YORK—June 24

The general market continues rather slow and inactive, but is inclined to be firm in prices as a rule.

Arsenic—The market continues rather slow, with a light demand only. The prices are unchanged, however. Quotations are $3 per 100 lb. for both spot and futures.

Copper Sulphate—There is a fair business doing in this article at unchanged prices. Quotations are $4.65 per 100 lb. for carload lots and $4.90 per 100 lb. for smaller parcels.

Nitrate of Soda—Some business is doing and sales are fair for the season. Prices have softened a little. Spot nitrate is quoted at 2.12½c. per lb., while 2.10c. is asked for futures.

Sulphur—Statistics of the Sicilian sulphur trade, as reported by the Consorzio Obbligato in metric tons are as follows for three years past:

	1911	1912	1913
Production	376,171	357,547	345,548
Exports to all countries	455,826	447,242	412,717
Stocks, Dec. 31	551,422	450,917	376,365

Exports to the United States in 1913 were only 1028 tons.

OTHER ORES

Manganese Ore quotations in England are: Indian or Brazilian, 50%, 18½@19c. per unit; 48%, 18 @ 18½c.; 45%, 17½@18c. Russian, 50%, 17@17½c.; 48%, 16½@17c. per unit, c.i.f. United Kingdom port.

COPPER SMELTER'S REPORTS

This table is compiled from reports received from the respective companies except in the few cases noted (by asterisk) as estimated, together with the reports of the U. S. Dept of Commerce as to imported material, and in the main represents the crude copper content of blister copper, in pounds. In those cases where the copper contents of ore and matte are reported, the copper yield then is reckoned at 97%. In computing the total American supply duplications are excluded.

	January	February	March	April	May
Alaska shipments	2,701,258	1,803,579	2,069,960	1,279,537	585,387
Anaconda	24,400,000	21,300,000	23,800,000	22,900,000	23,500,000
Arizona, Ltd.	3,474,000	3,062,000	3,286,000	3,570,000	3,092,000
Copper Queen	8,796,358	6,987,366	7,637,042	7,562,723	8,388,203
Calumet & Ariz.	5,975,000	5,596,850	5,875,000	5,450,000	5,495,000
Chino	6,488,220	5,642,426	5,399,814	5,926,591	.....
Detroit	1,590,681	1,814,214	1,973,725	1,790,926	2,105,034
East Butte	1,256,000	1,193,960	1,546,180	1,178,000	1,179,962
Giroux	148,411	90,017	287,980	45,948	429,553
Mason Valley	944,000	1,254,000	1,250,000	862,000	916,000
Mammoth	1,625,000	1,400,000	1,800,000	1,850,000	1,750,000
Nevada Con.	5,791,122	4,588,243	5,218,257	4,880,043	4,959,589
Ohio	700,728	582,000	597,520	610,518	.....
Old Dominion	2,797,000	3,066,000	2,997,000	2,779,000	3,302,000
Ray	5,705,000	5,432,000	6,036,908	6,089,362	6,495,719
Shannon	937,432	903,761	1,082,000	1,012,000	1,056,000
South Utah	275,569	333,874	406,381	247,641	55,394
Tennessee	1,474,890	1,232,812	1,262,184	1,370,800	1,336,950
United Verde*	3,000,000	2,700,000	3,100,000	3,000,000	.....
Utah Copper Co.	10,329,564	9,207,111	12,323,493	12,739,757	3,208,483
Lake Superior*	7,400,000	8,500,000	11,000,000	13,000,000	.....
Non-rep. mines*	8,200,000	7,600,000	8,200,000	8,000,000	.....
Scrap, etc	2,500,000	2,500,000	2,500,000	2,500,000	.....
Total prod.	106,600,238	96,790,213	107,036,667	108,554,846	.....
Imp., bars, etc.	24,504,249	19,918,448	22,676,605	17,043,191	.....
Total blister	131,104,482	116,708,661	129,713,272	125,598,035	.....
Imp. ore & matte	10,893,969	9,713,164	7,029,646	10,400,122	.....
Total Amer.	141,998,968	126,421,825	136,742,918	135,998,157	.....
Miami†	3,258,950	3,316,482	3,361,100	3,130,772	3,347,000
Shattuck-Arizona	1,276,636	1,134,480	1,136,458	1,386,594	1,353,043
Brit. Col. Cos.:					
British Col. Cop.	607,930	.....	.....	.....	.....
Granby	1,793,840	1,661,212	1,775,852	1,692,102	.....
Mexican Cos.:					
Boleo†	2,369,920	1,984,080	2,535,680	2,204,720	2,213,120
Cananea	3,460,000	2,688,000	4,260,000	2,632,000	2,222,000
Moctezuma	3,024,556	2,642,543	2,882,884	2,654,926	2,834,616
Other Foreign:					
Braden, Chile	2,430,000	2,362,000	1,810,000	2,720,000	2,480,000
Cape Cop., S. Af.	519,680	459,200	660,800	468,160	.....
Kyshtim, Russia	1,559,040	1,534,400	.....	.....	.....
Spassky, Russia	902,720	902,720	896,000	904,960	.....
Exports from					
Chile	5,488,000	6,720,000	6,944,000	9,072,000	7,616,000
Australia	5,712,000	7,952,000	8,176,000	7,168,000	8,400,000
Arrivals-Europe‡	8,599,360	18,354,560	17,572,800	17,299,520	13,558,720

† Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.
‡ Does not include the arrivals from the United States, Australia or Chile.

COPPER STATISTICS

	United States			Visible Stocks.		
Month	U.S.Refin'y Production	Deliveries, Domestic	Deliveries, for Export	United States	Europe	Total
Year, 1912	1,581,920,287	819,665,948	746,396,452	.....	.....	.....
VI, '13.	121,860,853	68,362,571	68,067,901	67,474,225	77,235,200	144,709,425
VII....	138,074,602	58,904,192	78,480,071	52,814,606	77,904,000	124,808,606
VIII...	131,632,362	73,649,801	73,263,469	53,594,945	66,420,480	120,015,385
IX....	131,401,229	66,836,897	73,085,275	38,314,037	63,716,800	102,030,837
X.....	139,070,481	68,173,720	68,123,473	29,793,094	53,625,600	83,418,692
XI....	134,087,708	48,656,858	70,067,803	32,566,382	48,787,200	81,353,582
XII....	138,990,421	21,938,570	73,542,413	47,929,429	46,592,000	94,521,429
Yr., '13	1,622,450,829	767,261,760	869,062,784	.....	.....	.....
I, 1914.	131,770,274	47,956,955	87,955,501	91,438,867	53,916,800	145,355,667
II.....	122,561,007	47,586,657	83,899,183	87,296,685	50,108,800	137,405,485
III....	145,651,982	69,852,349	89,562,166	78,371,852	47,376,000	125,747,852
IV.....	151,500,531	63,427,633	82,345,216	64,609,319	46,435,200	111,044,519
V.....	142,308,287	55,592,170	72,710,477	70,337,001	52,371,200	122,708,201
VI....	.....	.....	.....	84,342,641	61,062,400	145,405,041

Note—Visible supplies in Europe do not include copper afloat.

Assessments

Company	Delinq.	Sale	Amt.
Argenta, Ida	June 1	July 2	$0.001
Buffalo, Mont	May 6	July 2	0.004
Cedar Talisman, Utah	June 12	July 6	0.005
Central Eureka, Calif	June 20	July 11	0.03
Cons. St. Gothard, Calif	June 17	July 8	0.25
Cons. Virginia, Nev	June 16	July 7	0.10
Dry Canon, Utah	June 10	July 6	0.01
Emerald, Utah	June 15	July 11	0.13
Gould & Curry, Nev	June 24	July 15	0.03
Great Eastern, Ida	June 1	July 2	0.005
Great Falls, Mont	June 12	July 2	0.0025
Hamburg-American, Ida	June 6	July 6	0.001
Hypotheek, Ida	June 12	July 14	0.01
Idaho-Los Angeles, Ida	June 19	July 17	0.003
Indian Pete, Utah	June 27	July 15	0.005
Laclede, Ida	June 20	July 14	0.003
Manhattan Cons	June 9	July 9	0.01
Mayflower, Ida	June 9	July 2	0.005
Mayflower, Mich	.....	July 9	1.00
Michigan, Utah	June 10	July 6	0.0025
Montello, Utah	June 10	July 6	0.005
North American, Utah	June 2	July 2	0.001
Ophir, Nev	June 8	June 30	0.10
Robbers' Roost, Calif	June 20	July 15	0.01
Santaquin Central, Utah	June 10	June 30	0.0025
Scorpion, Nev	June 15	July 7	0.01
Seg. Belcher, Nev	June 22	July 17	0.02
Snowshoe, Ida. postponed	.....	July 27	0.005
Sunset, Nev	May 25	June 29	0.02
Winona, Mich	.....	July 2	1.00

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1912	1913	1914	1912	1913	1914
January	56.260	62.938	57.572	25.887	28.983	26.553
February	59.043	61.642	57.506	27.190	28.357	26.573
March	58.375	57.870	58.067	26.875	26.669	26.788
April	59.207	59.490	58.519	28.284	27.416	26.958
May	60.880	60.361	58 175	28.038	27.825	26.704
June	61.290	58.990	.....	28.215	27.199	.....
July	60.654	58.721	.....	27.919	27.074	.....
August	61.606	59.293	.....	28.375	27.335	.....
September	63.078	60.640	.....	29.088	27.986	.....
October	63.471	60.793	.....	29.299	28.083	.....
November	62.792	58.995	.....	29.012	27.263	.....
December	63.365	57.760	.....	29.320	26.720	.....
Year	60.835	59.791	.....	28.042	27.576	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Best Selected	
	1913	1914	1913	1914	1913	1914
January	16.488	14.223	71.741	64.304	77.750	69.488
February	14.971	14.491	65.519	65.259	71.575	70.188
March	14.713	14.131	65.329	64.276	70.658	69.170
April	15.291	14.211	68.111	64.747	74.273	69.313
May	15.436	13.996	68.807	63.182	74.774	67.786
June	14.672	.....	67.140	.....	70.821	.....
July	14.190	.....	64.166	.....	69.446	.....
August	15.400	.....	69.200	.....	74.313	.....
September	16.328	.....	73.125	.....	78.614	.....
October	16.337	.....	73.383	.....	79.250	.....
November	15.182	.....	68.275	.....	73.825	.....
December	14.224	.....	65.223	.....	69.583	.....
Year	15.269	.....	68.335	.....	73.740	.....

New York, cents per pound, London, pounds sterling per long ton.

TIN

Month	New York		London	
	1913	1914	1913	1913
January	50.298	37.779	238.273	171.905
February	48.766	39.830	220.140	181.556
March	46.832	38.038	213.615	173.619
April	49.115	36.154	224.159	163.963
May	49.038	33.360	224.143	150.702
June	44.820	.....	207.208	.....
July	40.260	.....	183.511	.....
August	41.582	.....	188.731	.....
September	42.410	.....	193.074	.....
October	40.462	.....	184.837	.....
November	39.810	.....	180.869	.....
December	37.635	.....	171.736	.....
Av. year	44.252	.....	206.279	.....

New York in cents per pound; London in pounds sterling per long ton.

LEAD

Month	New York		St. Louis		London	
	1913	1914	1913	1914	1913	1914
January	4.321	4.111	4.171	4.011	17.114	19.665
February	4.325	4.048	4.175	3.937	16.550	19.606
March	4.327	3.970	4.177	3.850	15.977	19.651
April	4.381	3.810	4.242	3.688	17.597	18.225
May	4.342	3.900	4.226	3.808	18.923	18.503
June	4.325	.....	4.190	.....	20.226	.....
July	4.353	.....	4.223	.....	20.038	.....
August	4.624	.....	4.550	.....	20.406	.....
September	4.698	.....	4.579	.....	20.648	.....
October	4.402	.....	4.253	.....	20.302	.....
November	4.293	.....	4.146	.....	19.334	.....
December	4.047	.....	3.929	.....	17.798	.....
Year	4.370	.....	4.238	.....	18.743	.....

New York and St. Louis cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1913	1914	1913	1914	1913	1914
January	6.931	5.262	6.854	5.112	26.114	21.533
February	6.239	5.377	6.089	5.228	25.338	21.413
March	6.078	5.250	5.926	5.100	24.605	21.460
April	5.641	5.113	5.491	4.963	25.313	21.569
May	5.406	5.074	5.256	4.924	24.583	21.393
June	5.124	.....	4.974	.....	22.143	.....
July	5.278	.....	5.128	.....	20.592	.....
August	5.658	.....	5.508	.....	20.706	.....
September	5.694	.....	5.444	.....	21.148	.....
October	5.340	.....	5.188	.....	20.614	.....
November	5.229	.....	5.083	.....	20.581	.....
December	5.156	.....	5.004	.....	21.214	.....
Year	5.648	.....	5.504	.....	22.746	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1913	1914	1913	1914	1913	1914
January	$18.15	$14.94	$17.35	$13.23	$18.59	$13.90
February	18.15	15.06	17.22	14.12	18.13	14.09
March	18.15	15 07	16.96	13.94	17.53	14.18
April	17.90	14.90	16.71	13.90	16.40	14.10
May	17.68	14.90	15.80	13.90	15.40	14.23
June	17.14	.....	15.40	.....	15.10	.....
July	16.31	.....	15.13	.....	14.74	.....
August	16.63	.....	15.00	.....	14.88	.....
September	16.65	.....	15.04	.....	14.93	.....
October	16.60	.....	14.61	.....	14.80	.....
November	16.03	.....	13.91	.....	14.40	.....
December	15.71	.....	13.71	.....	14.28	.....
Year	$17.09	.....	$15.57	.....	$15.77	.....

STOCK QUOTATIONS

COLO. SPRINGS June 23

Name of Comp.	Bid.
Acacia	.02
Cripple Cr'k Con	.006
C. K. & N	.04½
Doctor Jack Pot	.05½
Elkton Con	.44½
El Paso	1.36
Findlay	.008
Gold Dollar	.02
Gold Sovereign	.01
Golden Cycle	1.00
Isabella	.10½
Jack Pot	.05
Jennie Sample	.03½
Jerry Johnson	.03
Lexington	.004
Old Gold	.01
Mary McKinney	.52½
Pharmacist	.009
Portland	1.11½
Vindicator	1.09½

SALT LAKE June 23

Name of Comp.	Bid.
Beck Tunnel	.03½
Black Jack	.05½
Cedar Talisman	.00½
Colorado Mining	.11
Crown Point	.01½
Daly-Judge	4.75
Gold Chain	.08
Grand Central	.50
Iron Blossom	1.32½
Little Bell	.15
Lower Mammoth	.00½
Mason Valley	2.35
May Day	.06½
Opohongo	.01
Prince Con	.16½
Silver King Coal'n	2.82½
Silver King Cons	1.75
Sioux Con	.09½
Uncle Sam	.04
Yankee	.02

TORONTO June 23

Name of Comp.	Bid.	Name of Comp.	Bid.
Bailey	.00½	Foley O'Brien	.25
Coniagas	7.00	Hollinger	18.35
Peterson Lake	.33½	Imperial	.01½
Right of Way	.03¾	Jupiter	.08
T. & Hudson Bay	67.00	Pearl Lake	.03
Timiskaming	.14	Porcu. Gold	‡.01
Wettlaufer-Lor	.05½	Preston E. D	.01
Big Dome	8.50	Rea	.13
Crown Chartered	.00¾	Swastika	.01
Dome Exten	.07½	West Dome	.05

SAN FRANCISCO June 23

Name of Comp.	Bid.	Name of Comp.	Bid.
Comstock Stocks		Misc. Nev. & Cal.	
Alta	.06	Belmont	6.70
Belcher	.28	Jim Butler	1.00
Best & Belcher	.04	MacNamara	.02
Caledonia	.44	Midway	.23
Challenge Con	‡.05	Mont.-Tonopah	.70
Chollar	.02	North Star	.28
Confidence	.20	West End Con	.75
Con. Virginia	.11	Atlanta	.15
Crown Point (Nev.)	.20	Booth	.04
Gould & Curry	.04	C.O.D. Con	.03
Hale & Norcross	.03	Comb. Frac	.05
Mexican	.34	Jumbo Extension	.21
Occidental	.70	Pitts.-Silver Peak	.32
Ophir	.11	Round Mountain	.36
Overman	.21	Sandstorm Kendall	.10½
Potosi	.01	Silver Pick	.08
Savage	.05	Argonaut	3.00
Sierra Nevada	.06	Brunswick Con	1.40
Union Con	.08	Central Eureka	.11
Yellow Jacket	.33	So. Eureka	1.25

N. Y. EXCH. June 23

Name of Comp.	Clg.
Amalgamated	70⅛
Am.Sm.&Ref. com	63½
Am. Sm. & Ref., pf.	101½
Am. Sm. Sec., pf. B.	82
Anaconda	31
Batopilas Min	.50
Bethlehem Steel, pf.	84
Chino	41⅞
Colo. Fuel & Iron	27
Federal M. & S., pf.	32
Great Nor., ore., ctf.	32
Guggen. Exp	54½
Homestake	115½
Inspiration Con	17⅜
Mex. Petroleum	60
Miami Copper	22½
Nat'l Lead, com	15½
National Lead, pf	107½
Nev. Consol	14
Ontario Min	2½
Phelps Dodge	175
Quicksilver, pf	2½
Ray Con	21
Republic I&S, com	22⅜
Republic I&S, pf	86½
SlossSheffi'd, com	26
Sloss Sheffield, pf	84½
Tennessee Copper	34
Utah Copper	58½
U. S. Steel, com	61⅜
U. S. Steel, pf	109⅜

N. Y. CURB June 23

Name of Comp.	Clg.
Beaver Con	.31½
Big Four	.04
Boston Montana	9⅛
Braden Copper	7½
B. C. Copper	1⅛
Buffalo Mines	⅛
Can. Cop. Corpn	2½
Can. G. & S	.08½
Caribou	.63
Chambers Ferland	.17½
Con. Ariz. Sm	9/16
Coppermines Cons	1⅛
Davis-Daly	.65
Diam'field-Daisy	.05
Ely Con	.05
Florence	.43
Gold Hill Con	7/16
Goldfield Con	1.43½
Greene Cananea	33
Greenwater	‡.06¼
Kerr Lake	5½
La Rose	1 7/16
McKinley-Dar-Sa	.66
Mines of Am	2 13/16
Mother Lode	‡.26
Nevada Hills	.34
New Utah Bl	‡.68
Nipissing Mines	6¼
Ohio Copper	.32
Oro	.09½
Puebla S. & R	2¼
Stand'd Oil of N.J.	403
Stand'd Silver Lead	1 13/16
Stewart	1 3/16
Tonopah	6¼
Tonopah Ex	2 9/16
Tonopah Merger	.45
Tularosa	⅛
West End Ex	.04
Yukon Gold	2½

LONDON June 12

Name of Comp.	Clg.
Camp Bird	£0 10s 0d
El Oro	0 14 3
Esperanza	0 16 3
Mexico Mines	4 15 0
Oroville	0 11 0
Santa Gert'dis	0 11 3
Stratton's	0 0 6
Tomboy	1 2 6

BOSTON EXCH June 23

Name of Comp.	Clg.
Adventure	1 3/16
Ahmeek	270
Alaska Gold M	26¼
Algomah	.92
Allouez	40
Am. Zinc	16
Ariz. Com., ctfs	4¼
Bonanza	.51
Butte & Balak	2⅞
Calumet & Ariz	64⅛
Calumet & Hecla	405
Centennial	16½
Cliff	1
Copper Range	36⅜
Daly West	1⅞
East Butte	10½
Franklin	4½
Granby	81
Hancock	15
Helvetia	.30
Indiana	3½
Island Cr'k, com	49½
Island Cr'k, pfd	87½
Isle Royale	20½
Keweenaw	3⅜
Lake	6½
La Salle	4½
Mass	4½
Mayflower	3⅜
Michigan	.60
Mohawk	44
New Arcadian	5½
New Idria Quick	3½
North Butte	25⅛
North Lake	1
Ojibway	.75
Old Colony	4
Old Dominion	47½
Osceola	76
Quincy	56
Shannon	5
Shattuck-Ariz	23½
Superior	27
Superior & Bost	2½
Tamarack	35
Trinity	3½
Tuolumne	.35
U. S. Smelting	35½
U. S. Smelt'g, pf	47
Utah Apex	1½
Utah Con	11½
Victoria	2⅜
Winona	2⅜
Wolverine	40
Wyandot	.65

BOSTON CURB June 23

Name of Comp.	Bid.
Bingham Mines	.04½
Boston & Corbin	.28
Boston Ely	.25
Butte & Lon'n Dev	.33
Calaveras	1⅜
Chief Cons	.85
Contact Copper	‡.05
Corbin	1
Cortez	.25
Crown Reserve	1
Eagle & Blue Bell	.95
First Nat. Cop	1 13/16
Houghton Copper	2
Majestic	.20
Mexican Metals	.23
Moneta Pore	‡.62
Nevada-Douglas	1½
New Baltic	1⅜
Oneco	.70
Raven Copper	.09
Smokey Dev	.15
So. Lake	3½
S. W. Miami	‡1
Tonopah Victor	.35
Trethewey	.13
United Verde Ext	.78

‡Last Quotation.

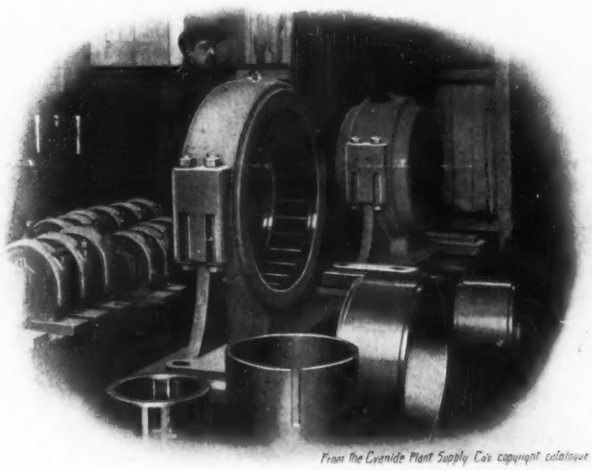
The Engineering and Mining Journal

Volume 97, No. 26
Issued Every Saturday
Hill Publishing Company

NEW YORK, JUNE 27, 1914

Price, 15 Cents
Contents, First Page
Advertising Index, Last Page

USED throughout the great new works of the most famous firm of Electrical Engineers of the day. Used also throughout the new works of Messrs. Vickers Limited. Used for the great cranes building the giants of the White Star Line. Used for the turntables, locomotive big ends, on rolling stock of some of the most famous railways of the world. Adopted by Krupp (Essen).



From the Cyanide Plant Supply Co's copyright catalogue

USE

COOPER ROLLER BEARINGS

on your Tube and Hardinge Mills

They Abolish 95% of Friction Loss and stand up against the heaviest work. Save from 15 to 25% of your power bill on big work.

A letter received June 6th states, "At Carnon Valley where they have two Johnson Tube Mills identical in every particular except for the bearings, they find that it takes **four men on the pulley** to move the tube mill with ordinary bearings but that **one man with his hands on the shafting** is able to move the mill with Cooper Bearings."

This would be well nigh incredible, were it not paralleled by a similar experience at the Consolidated Langlaagte at Johannesburg, where they found that *one* man could swing one of their Standard Tube Mills fully laden with pebbles and pulp charge when fitted with Cooper Roller Bearings.

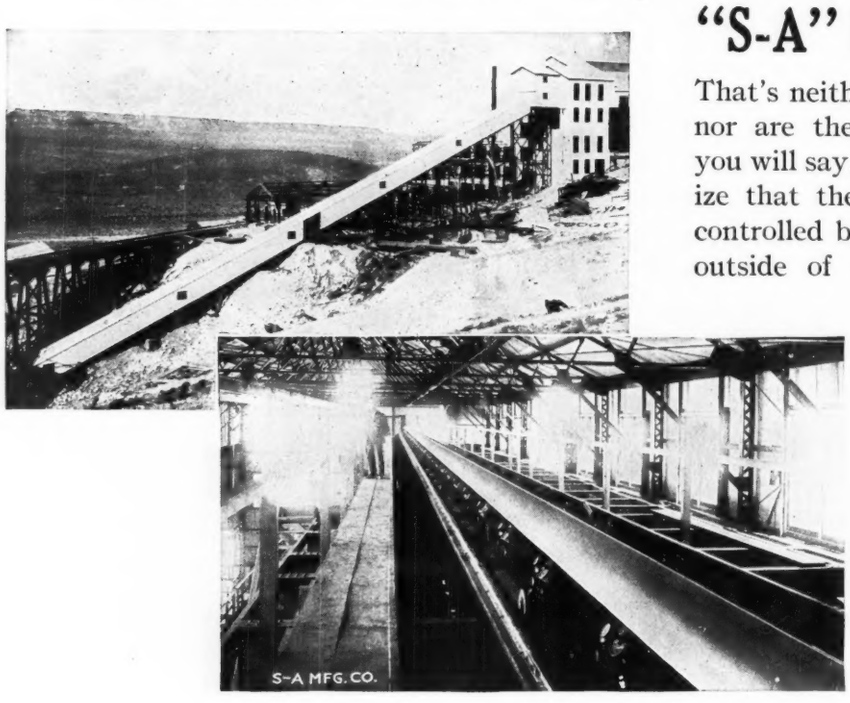
The Cyanide Plant Supply Co.

London, E. C.

The S-A Journal

Published Weekly in the Interests of S-A Conveying Engineering

900 Tons Per 8-Hour-Day Over 582 Feet of "S-A" Belt Conveyors



That's neither a very great capacity nor are they very long conveyors, you will say. BUT—when you realize that the conveyors are entirely controlled by one man, that upkeep outside of the belt is practically nothing and that the power required is extremely low, you will see that Goldfield Consolidated Mining Co. has an extraordinary conveyor installation.

We specialize in that first—extraordinary systems. Our success in this field is emphasized by the fact that a large percentage of the great ore mills in the country have "S-A" Conveyors in use.

We have a Board of Engineers—experts in conveying problems—who are always at your service for the preparation of plans and estimates. Your correspondence is invited.

Automatic Cleaning Brush for Belt Conveyors—

The "S-A" Rotary Cleaning Brush is a simple device for cleaning the conveyer belt when handling sticky material. It is driven by a sprocket chain from the head pulley. Prices on application.

Have you seen our new Belt Conveyor Book? You can't afford to miss it. Write for your copy.

Stephens - Adamson Mfg. Co.

Conveying, Screening, Transmission Machinery

Aurora, Ill.

Branch Offices:

50 Church St., NEW YORK
First National Bank Bldg., CHICAGO
79 Milk St., BOSTON, MASS.
H. W. Oliver Building, PITTSBURGH
803 New Bank of Commerce Bldg., ST. LOUIS, MO.
430 Central Bldg., LOS ANGELES
503 Dooly Block, SALT LAKE CITY

Australian Agent—Arthur Leplastrier & Co., Circular Quay East, Sydney.
South African Agent—J. Mac G. Love & Co., Limited, 1 and 3 London House, Loveday St., Johannesburg.

The Engineering and Mining Journal

WALTER RENTON INGALLS, *Editor*

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JOHN A. HILL, Pres. ROB'T MCKEAN, Sec'y.
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NUMBER OF COPIES PRINTED THIS ISSUE 10,000

None sent free regularly, no returns from news companies, no back numbers.

THE READER'S PAGE

Mr. William C. Freeman who writes the daily "Advertising Talks" for the *New York Globe* is a strong exponent of advertising and the universal good it renders the buyer.

In one of his recent talks, Mr. Freeman says:

"It is really a pleasure to read the advertisements in these days. Maybe I notice the great difference between the style of the advertisements of today and that of years ago because of my very long connection with the advertising business.

"Yet the difference is no doubt also noticed by thousands of people who are 30 years of age or younger, because the greatest improvement in advertising copy, in illustrations, and in typographical effects has been made in the last ten years.

"Advertising is regarded by manufacturers and merchants as the most economical as well as the most direct way to make known to the public what they have for sale. The poster effect—big, black display type and black price figures—so prevalent years ago, has given way to informative description of merchandise, artistically illustrated, and a real effort to present an appearance that will pleasantly impress the public.

"It would not do for all manufacturers and merchants to employ the same style of advertising any more than it would do to erect all the buildings of a city in the same style. There must be a variety of taste displayed, and there is.

"One advertising architect works out a variety of plans for his clients—another works out plans for his—and since there are many very fine architects, the general variety of appearance of the advertisements is most attractive.

"There is but one thing that all can do, and that they must do in advertisements, and that is tell the truth. For the most artistic advertisement, the most beautifully worded, will fail in results if it does not carry the conviction that it is truthful.

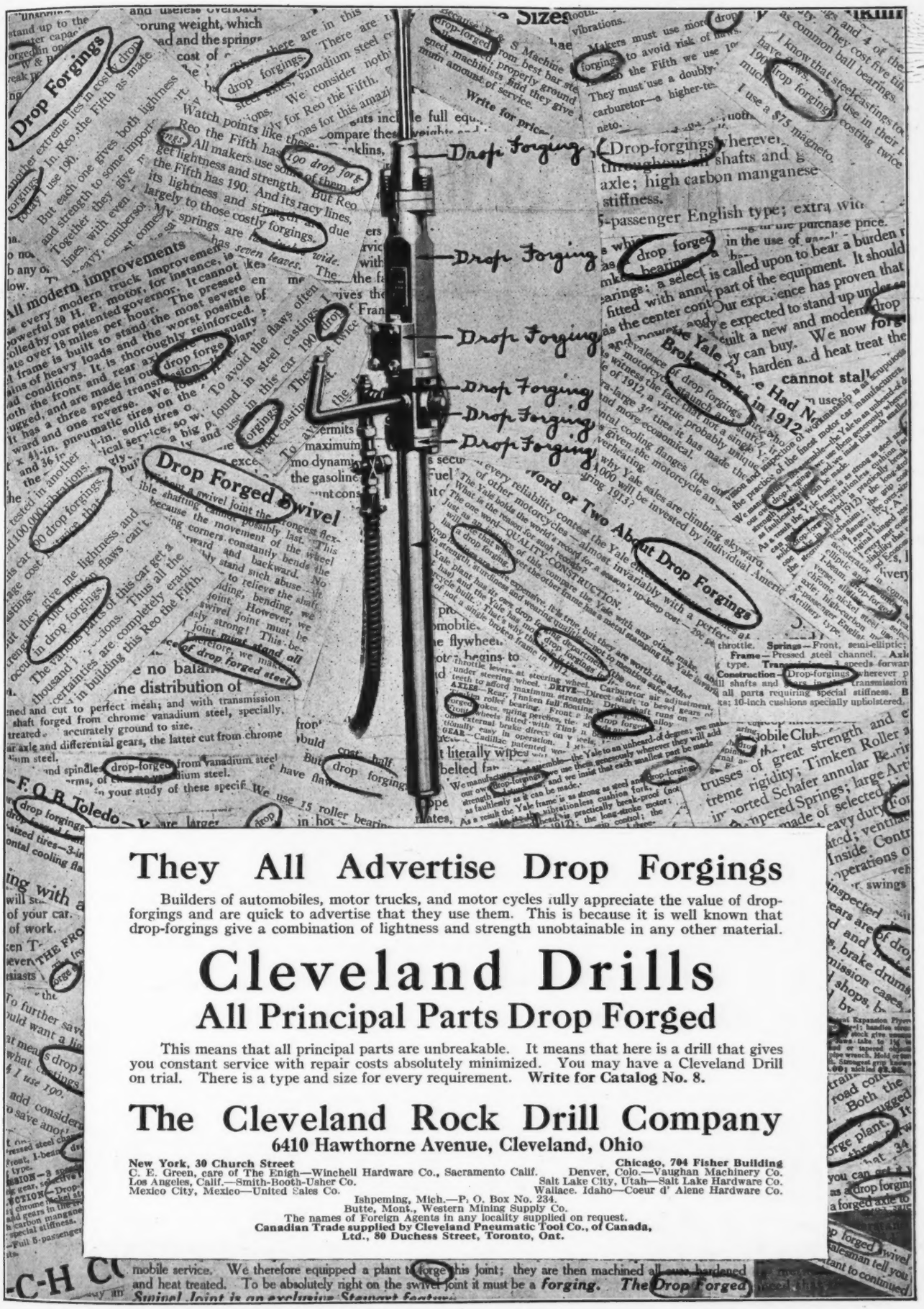
"It will PAY everybody to read advertisements besides giving them pleasure. Some of the best news stories of the day appear in the advertisements, even though they are written to sell you something. But you need these 'somethings,' so read about them and buy them where you know you will get them good and at right prices."

The good which you readers of THE ENGINEERING & MINING JOURNAL can get out of its advertising pages is measured only by the time you put into the reading of the ads.

"Service to the buyer" is written across every advertising page here.

How much are you profiting by it?

The Ad Manager


Drop Forging
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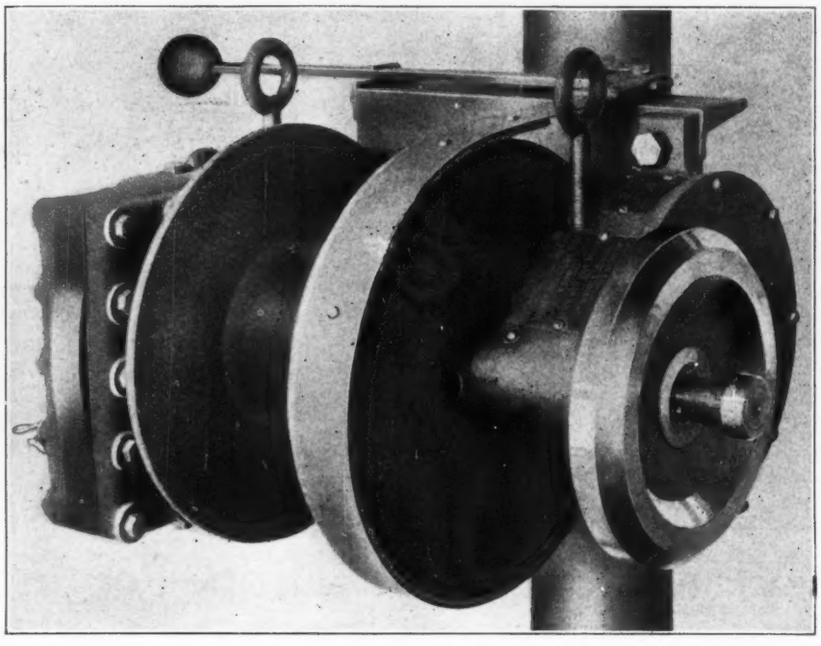
LEADVILLE DRILL COLUMN HOIST



COMPACT ∴ LIGHT ∴ STRONG

As Portable As Your Drills

We are getting out a new Catalog describing these hoists in detail. Want a copy?

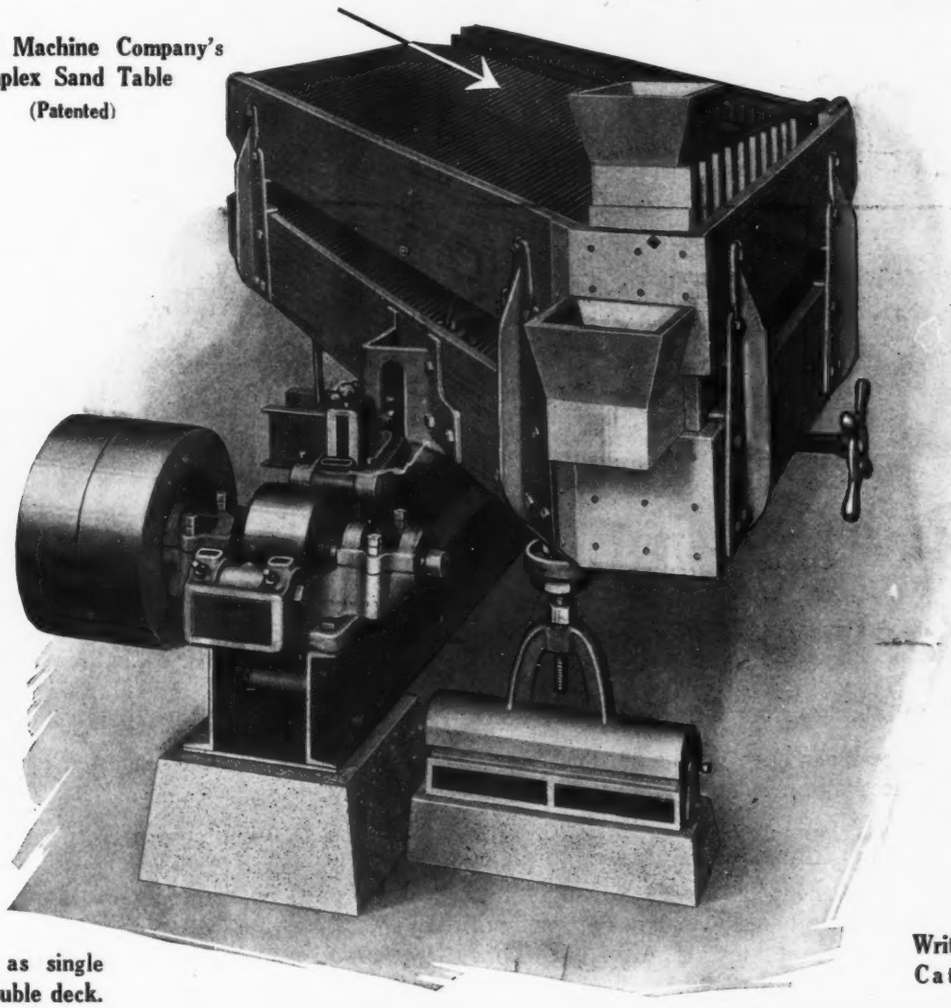
THE HENDRIE & BOLTHOFF

MFG. & SUPPLY CO.

DENVER, COLORADO.

LATEST DEISTER SUCCESS
IN
CONCENTRATING TABLES
OUR DUPLEX PLATEAU along mineral discharge side THE REASON

Deister Machine Company's
Simplex Sand Table
(Patented)



Also kindly write for our latest slime table and classifier bulletins.

Built as single or double deck.

Write for our new Catalog Now.

Miami Copper Company equipping entire section replacing their Single Deck Deister Tables with OUR LATEST TYPE DOUBLE DECK SAND TABLES

DEISTER MACHINE COMPANY

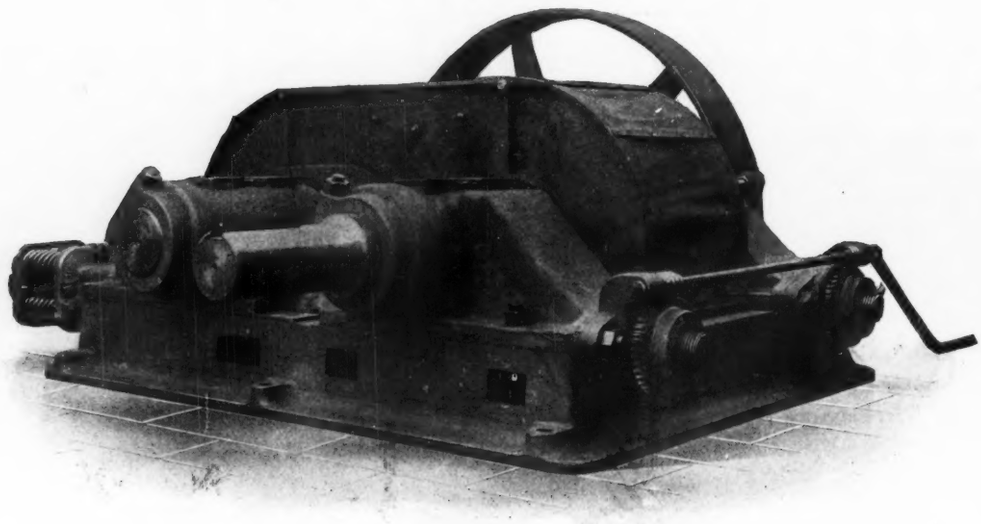
INCORPORATED JULY, 1912

Home Office and Factory:
East Wayne Street
Fort Wayne, Ind., U. S. A.

London Office:
562 Salisbury House
London Wall, E. C.

Machinery Of Quality

DENVER ENGINEERING WORKS



Of the most recent design Backed by 15 years' experience

We are talking of our Crushing Rolls, Convertible 1910 type.

Into these Rolls have gone all the improvements we have ever heard suggested by experienced mill men and metallurgical engineers.

And the chief points of superiority are right here. All adjustments made without stopping rolls—distance between Roll Shells adjusted by worm gear and crank—lateral adjustment of shaft—Swivel Bearings, self-aligning, no cramping of shaft in bearing when one side of Rolls opens more than the other—bottom as well as top of Frame machine finished—Bronze Bushings—grit-proof bearings—Journal Boxes interchangeable and very large—renewable wearing plates under sliding pedestals—shafts removed without disturbing tension bars or springs. Rigid and Spring Roll parts interchangeable, requiring only one set of spare parts.

Yes, Bulletin No. 1046 will interest You. SEND FOR YOUR COPY.

MANUFACTURERS:

Electric Hoists	**Ore Crushers**	**Crushing Rolls**
Richards Pulsator Jigs	**Ovoca Classifiers**	**Mine Cages**
Richards Pulsator Classifiers		

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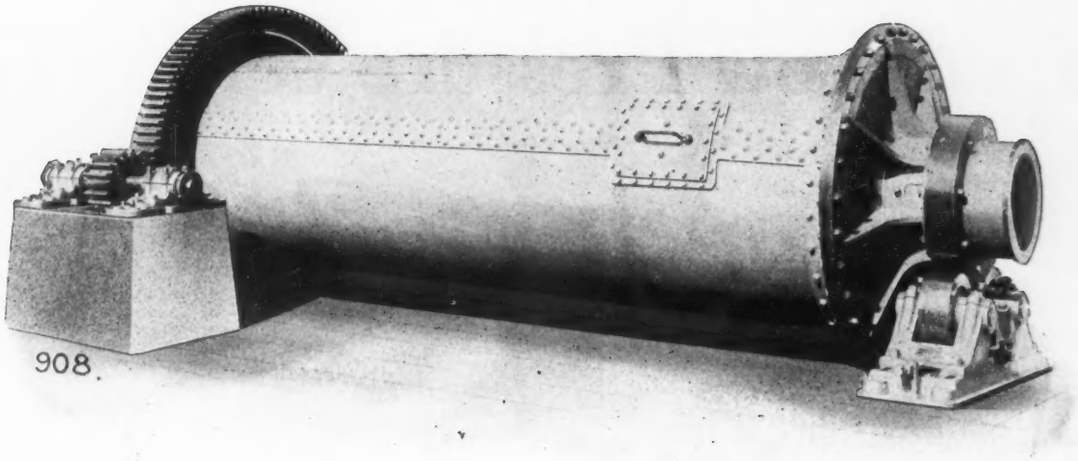
The Denver Engineering Works Co.

For The Mine And Mill

DENVER ENGINEERING WORKS



The Tube Mill with the Large Discharge Opening

Any good Tube Mill is granted to be the best machine for fine grinding.

Because it is low in first cost, maintenance cost, operating cost—and exceedingly simple in construction.

But the Tire and Trunnion Type of Tube Mill is something more than "any good Tube Mill." It is improved—modernized.

Chief of its improvements is the large discharge opening increasing its efficiency a considerable degree.

Our Bulletin No. 1068 is really a treatise on the Tube Mill and its uses—with data of tests, capacities, etc. We shall be glad to mail you a copy on request.

MANUFACTURERS:

Stamp Mills	**Mine Timber Framing Machinery**	**Automatic Samplers**
Tube Mills	**Revolving Screens and Grizzlies**	**Sample Grinders**

176

Denver, Colorado, U. S. A.

Get More Service Out of That Drill

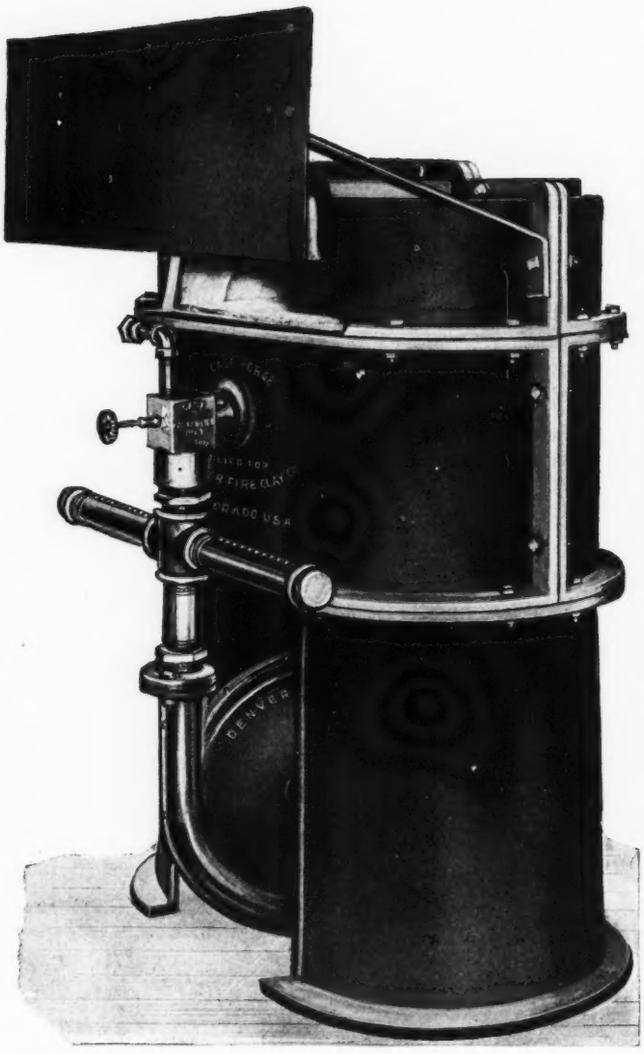
by using the

Case Low Pressure Oil Forge

Drill steel heated in this forge gives longer service because it does not chip. With the old coal or coke furnace the fuel invariably contains considerable sulphur which means that the drill steel becomes sulphurized and weakened.

Another feature of this Case is that the drills are always under observation—you never work in the blind.

It is noiseless and smokeless. Saves from 20 to 40 per cent. in fuel for the work accomplished and the number of heat units produced. A trial will convince you that this is the most economical forge ever manufactured.



Our latest furnace book is the up-to-the-minute catalog of metallurgical furnace equipment. It's just off the press. It's yours for the asking. Send for a copy now.

The Denver Fire Clay Company

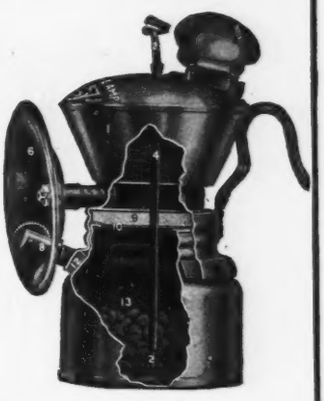
Established 1876 **Incorporated 1880**

Denver, Colorado, U. S. A.

Largest Manufacturers Of Furnaces In The World

Manufacturers Of Assayers' And Chemists' Supplies

How to Judge a Carbide Mine Lamp



Buying a carbide lamp is something like hiring men. You are not so much interested in their appearance as you are in what they have done and what they can do. All things being equal, you'll pick the better looking fellow, for appearances cannot help but impress, still the big thing is, "What have they done and what can they do?"

It is very much like this in selecting a mine lamp. What the lamp will do is what interests you, and what it has done is your guide to what you may reasonably expect of it.

Five things determine the value of a carbide mine lamp.

1st. What does it cost? 2nd. How long will it last? 3rd. Will it reduce an expense? 4th. Will your men be able to use it? 5th. Who is using it and why?

WHAT DOES IT COST?—While price is quite an item, you should be guided by what you are going to get for your money, how much value you will receive—the cost of the **Baldwin** is no greater than that of any other Carbide Mine Lamp, but the value received is considerably greater.

HOW LONG WILL IT LAST?—That's a hard one to answer. We might say six months, we might also say two years, and we could furnish proofs of either statement. It's entirely up to the user, the amount of care he exercises. You can better judge of the Baldwin's durability from this—if the lamp's durable, a superintendent will order again—naturally. Well, 74% of Baldwin Lamps sold in 1913 were purchased on repeat orders.

WILL IT REDUCE AN EXPENSE?—Yes—if you are using oil or candles, the Baldwin will cut your lighting expense all of 50%. In the case of oil or candles, the Baldwin will save 50% because it's just that much cheaper, you cut your lighting bill one-half, and your men have a better and more healthful light to work with. The Baldwin will use less carbide than other lamps, because the original patented water feed makes the Baldwin proof against the miner's carelessness. This water feed will unerringly do what the miner will forget to do, and that is, prevent overfeeding water to the carbide. Too much water spells waste. There can never be too much water with the Baldwin, the automatic feed prevents this.

WILL YOUR MEN BE ABLE TO USE IT?—Yes—not only men, but thousands of boys use them; there's really nothing complicated about it, simply put in the carbide—fill the water chamber—screw together and light. About once or twice during a shift it is necessary to rotate the raking wire. The miner can do this without even stopping to look at the lamp. No bothering with adjusting screws and valves, as one must do with a hand-regulated lamp. Simply fill and light, that's all.

WHO IS USING THE BALDWIN AND WHY?—Let us answer that by our sales. We are selling to most of the larger mining concerns in this country. Before purchasing, many of these companies carried on extensive experiments, first to determine whether it would pay them to use carbide, next to decide which lamp they would use.
Now if these companies had only placed a single order with us, it would very plainly indicate their opinion of the Baldwin, since however, they ordered again and continued to order, it must prove very conclusively that they found the Baldwin more satisfactory than others.

FINALLY—The Acid Test—The Lamp Itself

We will send a Baldwin free of charge to any mine owner or superintendent not using our lamps, and who is interested in a good light. Fill out the attached coupon and tell us what you now use for lighting, so we can send the right lamp.

There's no time like the present—why not write today?

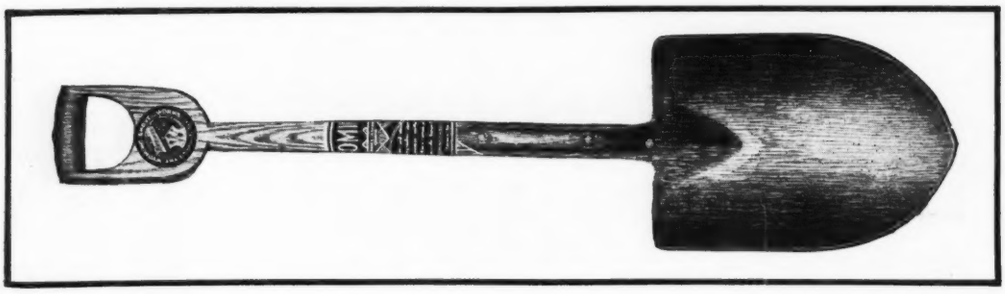
John Simmons Company

104 Centre St., New York

BRANCHES { 268A Market St., San Francisco, Cal.
140 Bleury St., Montreal, Can.

JOHN SIMMONS COMPANY, 104 CENTRE STREET, NEW YORK
Baldwin Lamps are not used in our mines. I will thoroughly test a lamp if sent FREE OF CHARGE

I am superintendent of.....
Name of mine and company.....
No. of men employed underground.....
Signed.....
Address.....
20



Doubling the Capacity of the Shovelers Was Not Enough!

The Wyoming 21-Pound Load Shovels double a shoveler's capacity.

That point has been amply proved. (See "Scientific Shoveling"—sent on request.)

Now we have gone beyond the efficiency idea and have produced the most remarkable shovel that the industrial world has known.

It is remarkable because it is so wear resistant as to be *practically* indestructible.

Imagine buying shovels *once* and having them last far beyond all your previous experiences with shovels! Yet this is literally and absolutely true in the case of

WYOMING-MAYARI
21-POUND LOAD
SHOVELS

They're made of Mayari Steel, the ore of which is mined in Cuba. This remarkable ore contains in its natural state those alloys which make steel tough and wear-resistant. When properly rolled and heat treated in our shop this steel is infinitely more wear-resistant than any ever before used in hand shovels.

A Wyoming-Mayari will gash any other shovel on the market. We've spoiled the edge of many a good cold chisel trying to make a mark on the edge of a Wyoming-Mayari Blade.

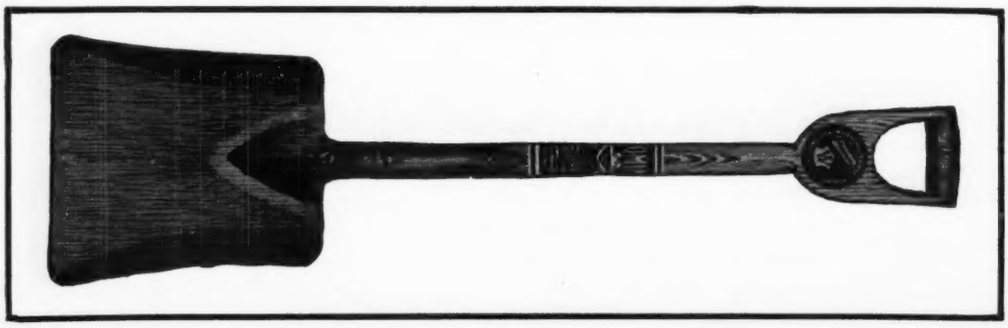
This combination of the "efficiency load" and Mayari steel puts the labor buyer and the shovel purchaser in a position to cut shoveling costs to the bone.

It's the best buy you can make.

A booklet which describes "Scientific Shoveling"—its discovery, its methods and the results it obtains and a book which describes Wyoming 21-Pound Load Shovels are here waiting for your request. You will oblige us by writing for them today.

The Wyoming Shovel Works, Wyoming, Pa.

Makers of good shovels for over 40 years.



The Wedge Mechanical Furnace

Patented

A Good Roaster is Profitable

The Wedge Roaster is the result of actual experience with the difficulties, annoyances and expense incident to old type roasters. Heretofore when you had a roasting problem, you had the choice between different types of stock machines. Today you can secure a roaster which will operate giving high furnace working days' efficiency, large tonnage and low operating cost, eliminating the unpleasant experiences you may have had heretofore.

This is made possible by the fact that we have for some years made a specialty of this one subject, learning how to develop a machine built with such special detail as may be adapted to each customer's requirements.

A first-class machine in which the arms may be changed and other REPAIRS MADE, incident to the operation of a roasting furnace, WITHOUT COOLING IT OFF, will cost more money to install than a furnace having a cast-iron shaft, but you increase your furnace working days' efficiency, tonnage, and lower your operating cost.

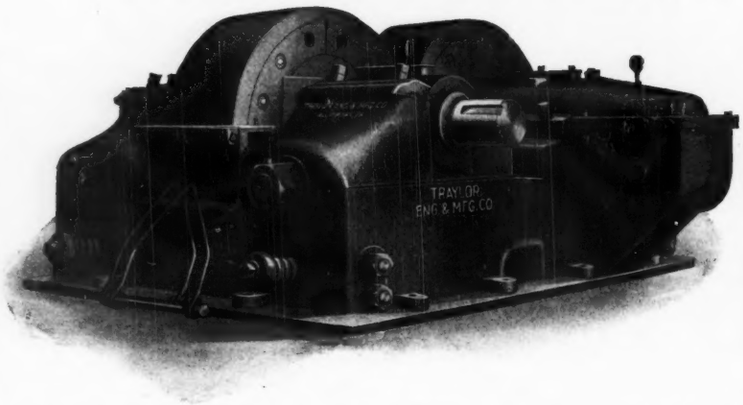
Economy in operating cost is more PROFITABLE than economy in installation cost at the expense of operating cost.

Write us stating analysis of the ore, concentrates, mixture or material you desire to roast, characteristics and physical condition of same, number of tons to be treated per twenty-four hours, and results desired in the calcine.

Wedge Mechanical Furnace Company

115 Chestnut St., Philadelphia

CRUSHING MACHINERY
FOR
CONCENTRATING PLANTS



ROLLS

for use where large capacities are desired.

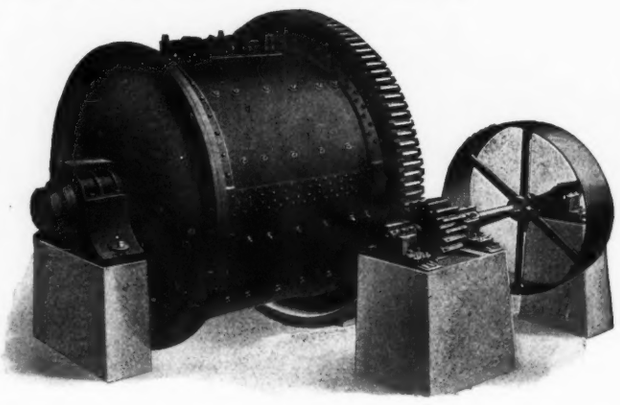
Traylor Crushing Rolls are superior because they require less power to produce large quantities of finely crushed material than any other type of fine crushing or recrushing machines.

The Traylor Rolls are fitted with an automatic side adjusting mechanism on the stationary shaft, which eliminates entirely corrugations on the roll shells and allows you to wear the roll shells down to less than 1/2″ thick; without in any way interfering with the operation of the machine.

Our "AA" type of rolls are designed to crush the hardest kind of iron ore, trap rock and quartz. Built in sizes from 18″ in dia. x 10″ face to 72″ in dia. x 36″ face.

Send for Catalogue G-2 thoroughly describing construction.

TUBE MILLS



The short tube mills as developed by us, are, we believe, of great importance for medium fine grinding with large capacities and high efficiency. These machines are built in sizes ranging from 4′-0″ to 7′-0″ in dia. by 6′-0″ long, fitted with improvements of the most modern design. Such as: **Heads** of dished type strongly ribbed that allow for pebble lining if necessary. **Spur Gears**, in sections made reversible and so designed that they can easily be removed from shell without interfering with any other part of mill.

Feed and **Discharge Trunnions** equipped with spiral liners to facilitate the feeding and discharging of material. **Spiral Scoop Feeder** fitted with a manganese steel lip allowing pebbles to be fed to mill while in operation.

Our tube mills are noted for the small amount of power consumed and the elimination of the breakage of the heads, because of the perfect alignment obtained by placing same in a large lathe and machining both bearings at the same time.

Builders of Stamp Milling, Concentrating, Rock Crushing, Cyaniding and Smelting Machinery.

Traylor Engineering & Manufacturing Company

Main Office and Works—Allentown, Pa.

New York Office—26 Church St. **Western Office—Salt Lake City, Utah.**

You Can Bend This Glass But You Can't Break It

You can drive nails through it. Expose it to flying chips—walk on it—but you can't smash, or even crack

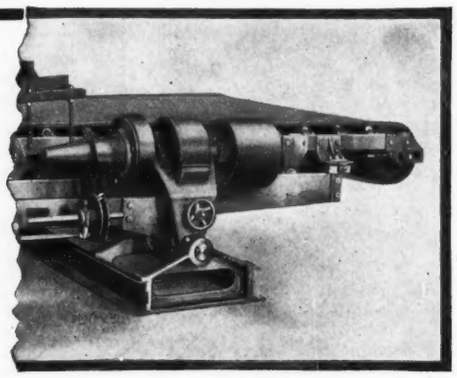
Rubberglass

IT'S a translucent fabric. If it were made specially for mining buildings it could not be better fitted for skylights and windows. Rubberglass withstands shock and vibration, heat and cold. It resists fire. It's as easy to put on a skylight or window as a board is to nail. It's cheaper than glass and gives a more perfect light for work. Let us send you a piece of Rubberglass with the full story of the material that is revolutionizing daylight among the mines. It's interesting and it's free, if you'll write now.

SEND US YOUR SPECIFICATIONS *or plans for skylights and windows and get our estimates for Rubberglass. Our figure will surprise you. Costs you nothing to get it, so why not have it?*

Angier Mills, Dept. B. Ashland, Mass.

The Isbell Vanner Is Dependable



The operator who has Isbells installed can apply his "gray matter" to things that count, he can do other things that just "keep the mill going."

¶ The Isbell Vanner is a 24-hour machine, that with little attention can be made to operate efficiently.

¶ Repair charges are absurdly low on these Vanners.

Ask for our Bulletin No. 1801.

Uninterrupted Power

is vital to the producing mine or reduction works; it makes profits possible; reliable prime movers make uninterrupted power possible; Allis-Chalmers' Steam Turbines and other prime movers have an undebatable record for reliability.

Your new power plant or proposed extensions should have the benefit of Allis-Chalmers' experience and of Allis-Chalmers' competition.

Allis-Chalmers Manufacturing Co.

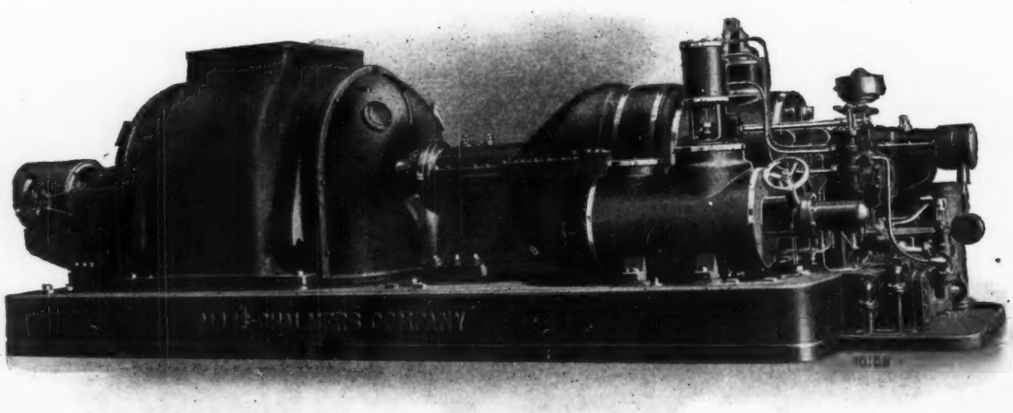
Mining Machinery Department **Milwaukee, Wisconsin**

District Offices in the Principal Cities of the United States

In Canada refer to Canadian Allis-Chalmers Company, Ltd., Toronto

Foreign Offices and Representatives in the important Mining Centers of the World

We illustrate the type of Steam Turbine installed at the International Smelter at Tooele, Utah, the United Verde at Jerome, Ariz., and other mining and reduction plants.



LEYNER-INGERSOLL ROCK DRILLS

There is no one class of user that makes more exacting demands of a rock drill than the mine operator.

With him it is essential not only that a rock drill be a rapid driller, easy to handle and operate, but it must also combine with these qualities low maintenance and power consumption so as to enable him to produce the ore at the lowest cost in order to mine at a profit.

That Leyner-Ingersoll Drills meet these exacting demands is best demonstrated by citing the following case—

Leyner-Ingersoll Drill at Work on the 1500-Foot Level of the Golden Cycle Mine, Cripple Creek, Colorado.

In a large Pennsylvania Lime Quarry they have 6 No. 18 Leyner-Ingersoll drills in use, averaging 82.9 feet of holes, per drill, per shift. The average repair cost is 16c. Formerly, using 3¼″ piston drills of a certain make, the average hole footage, per drill, per shift, was 69.5 feet and the repair cost 19c.

With 3¼″ piston drills of still another make the average hole footage was 57.8 feet and the repair cost 21c.

It will pay you to investigate the Leyner-Ingersoll. Ask for BULLETIN 4020.

INGERSOLL-RAND COMPANY

NEW YORK Offices the World Over **LONDON**

AIR COMPRESSORS **JACKHAMERS** **DRILL SHARPENERS**

1-LI

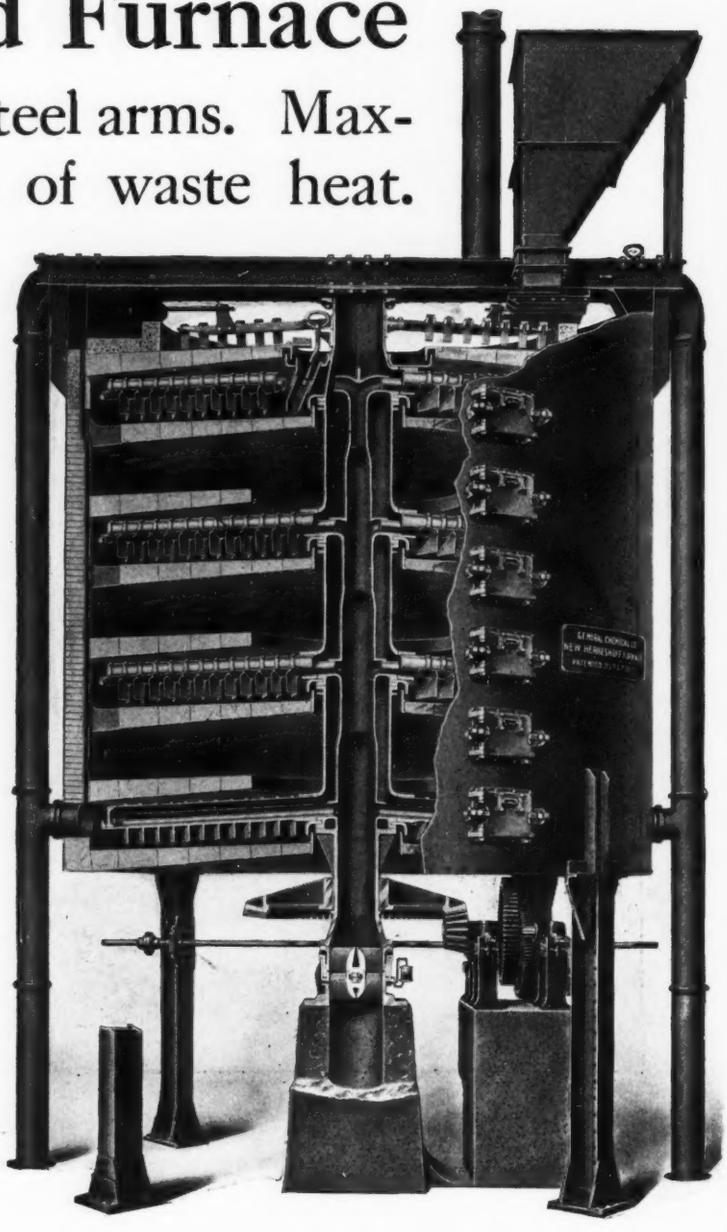
A Temperature-Controlled Air-Cooled Furnace

with removable steel arms. Maximum utilization of waste heat.

The New Herreshoff Furnace*

for Roasting Ores

(Patented)



Large capacity per square foot of hearth area, without Fusion.

How is this accomplished?

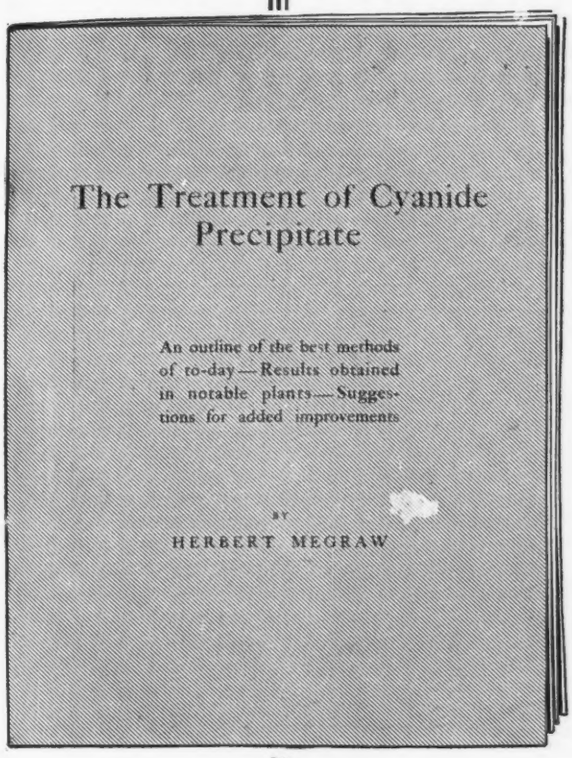
Our illustrated booklet tells the story—sent free on application.—Write for it today.

*** This new Furnace, with temperature control, and removable steel arms, is no experiment. This Company has successfully operated thirty of this type for several years, and now offer the public a perfected temperature-controlled air-cooled Roasting Furnace.**

The General Chemical Company

25 Broad Street **Herreshoff Furnace Department** **New York, N. Y.**

Pacific Coast Agents:—
Pacific Foundry Company, 18th and Harrison Streets, San Francisco, Cal.


The Treatment of Cyanide Precipitate
An outline of the best methods of to-day—Results obtained in notable plants—Suggestions for added improvements
BY
HERBERT MEGRAW

You Want a Copy of This Free Book

Every man who has anything to do with the treatment of cyanide precipitate wants a copy of the book—**"The Treatment of Cyanide Precipitate." For it is the best, the most up-to-the-minute, the most authoritative hand book on this subject extant.**

Mr. Herbert Megraw, who wrote "The Treatment of Cyanide Precipitate," was "brought up" in the metallurgical plants of Mexico and within the past year has visited every metallurgical plant in the United States.

In the book he tells of the Homestead Acid Treatment System, the Taverner Reverberatory Furnace System, the remarkable results at Tonopah Belmont and much besides.

You want his book for its comprehensiveness, its authoritativeness. We want you to have it because, incidentally it gives an entirely impartial, fair statement of what Monarch and Monarch-Rockwell Furnaces are doing.

Just fill in and return the coupon—no bother, no obligation, no cost to you. You simply get a book that is worth getting.

The Monarch Eng. & Mfg. Co.
1206 American Bldg., Baltimore, Md., U.S.A.

Specialists in Mill Equipment, Mfgs. of the Monarch-Rockwell Double Chamber, the Monarch Steele-Harvey Crucible Tilting and the Monarch Crucible Tilting Metal Furnace—all patented.

Catalog E M J 27

The Monarch Eng. & Mfg. Co.,
1206 American Bldg.,
Baltimore, Md.

Send me a copy of "The Treatment of Cyanide Precipitate."

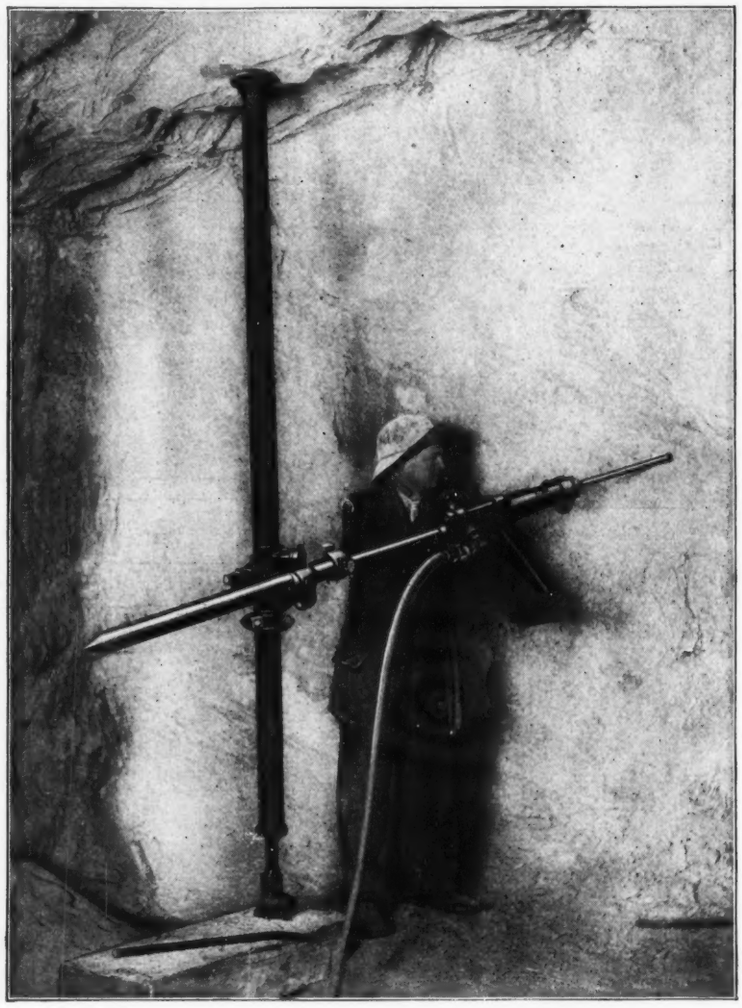
Name.....

Company.....

Address.....

Drift with Your Stoper?

Of course, if it's a Reverse-Feed Sullivan!



IN many instances, it is a convenience to be able to stope and drift with the same drill. The **Sullivan Reverse-Feed Stoper** fills this requirement admirably. For drifting, the feed cylinder is gripped in a simple clamp, that slips into a standard rock drill saddle on a bar or column arm.

Sullivan Air Jet Drifting Stoper, with Water Spray

When the drift is drilled up, the loosening of one bolt frees the tool for another round of uppers in the stope. **Air-Jet Stopers** are recommended where many flat holes are needed. A blast of air through the bit keeps the hole clean. Where dust is objectionable, a water spray may be attached to the drill.

There's a **Sullivan Stoper** just suited to give best results in **your** working conditions. **Bulletin 266-G.**

Air Compressors **Rock Drills** **Diamond Drills**

SULLIVAN MACHINERY CO.

122 So. Michigan Avenue **Chicago, U. S. A.**

Boston Spokane New York
London Pittsburgh Christiania
Birmingham Paris Knoxville
St. Petersburg St. Louis The Hague
Joplin Sydney Denver
Shanghai El Paso Turin
San Francisco Tokio

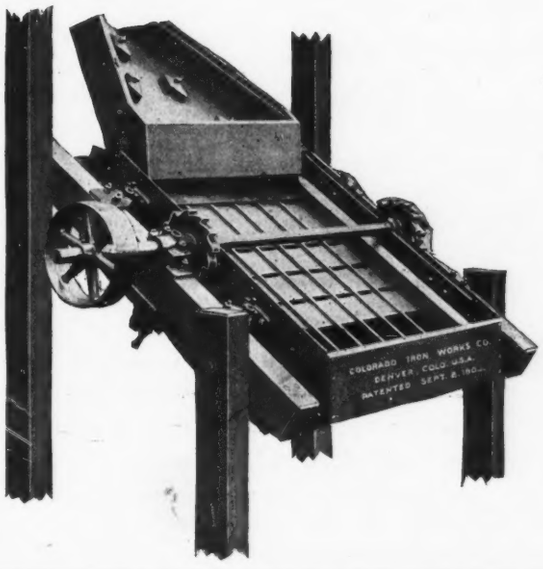
1860

COLORADO IRON WORKS COMPANY

ORE SMELTING EQUIPMENTS

ORE MILLING MACHINERY

1914



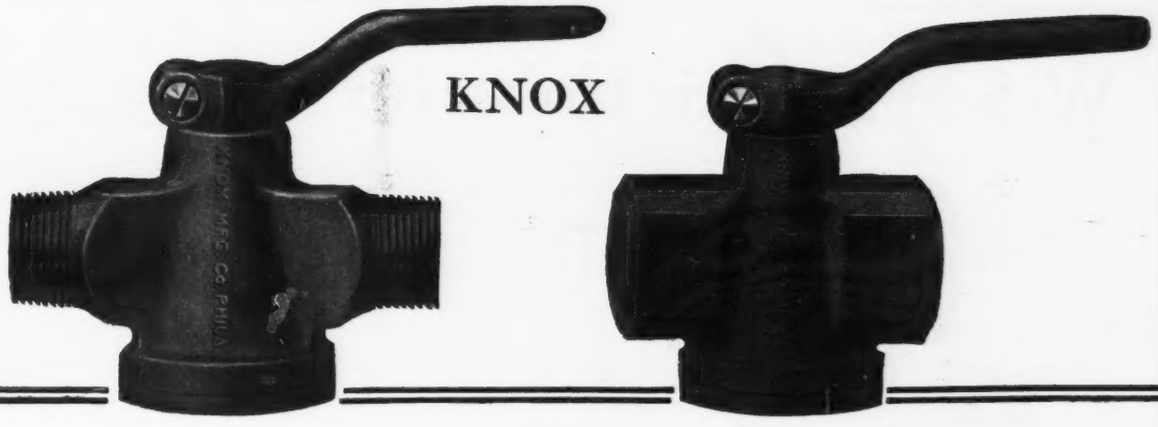
The Impact Screen

It has been in just those mills where the full advantage of efficient sizing is most keenly appreciated, and where the greatest capacity and lowest cost of maintenance are demanded, that the Impact Screen has most signally demonstrated its superiority over all other Screening devices.

It has most emphatically "made good."

Colorado Iron Works Co.
Denver, Colo., U. S. A.

KNOX



One Sent Free to Prove Its Worth

We realize that we must convince you that the Knox Throttle Valve is better. This is why we will send one free to all who sign the attached coupon.

You don't have to be a big user. So long as you use throttle valves at all, you will want to know how much better the Knox is.

And there's no red tape to our offer and no obligation on your part.

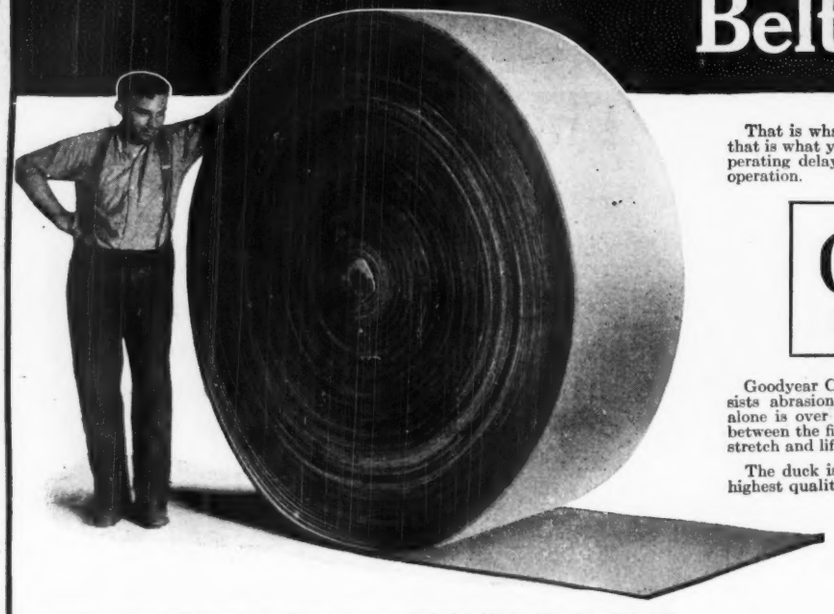
Three sizes—$\frac{1}{2}$", $\frac{3}{4}$", 1". Just sign the coupon and mail to us.

Knox Mfg. Co., Inc.,

821 Cherry St., Philadelphia

Knox Mfg. Co., Philadelphia, Pa.
Send us a Knox Throttle Valve, and let it be a.....inch size.
Name of company.....
Address.....
Requested by.....

Day-In-and-Day-Out Conveyor Belt Service



That is what you pay for—that is what you should **get.** And that is what you **do get** in Goodyear Conveyor Belting. No exasperating delays—no costly shut-downs, no expensive cessation of operation.

GOODYEAR AKRON, OHIO
Conveyor Belting

Goodyear Conveyor Belts have a strong, durable cover that resists abrasion and weather. The breaking strain of the cover alone is over a quarter of a ton to the square inch. Separation between the first ply of friction and the rubber is prevented by the stretch and life of the cover that takes up the strain.

The duck is specially woven. The rubber friction is also of the highest quality. This permeates the duck so thoroughly that ply separation simply cannot occur.

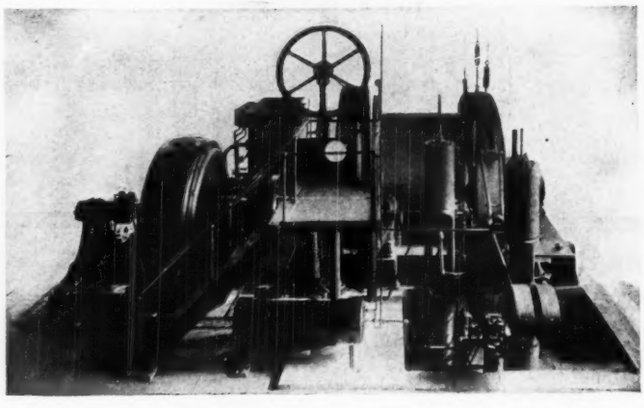
And this belt has the exclusive Metzler edge that prevents fraying, rot and mildew. All in all it is a belt of real service — real ECONOMY.

THE GOODYEAR TIRE & RUBBER COMPANY
Belting Department, AKRON, OHIO
Toronto, Canada **London, England** **Mexico City, Mexico**
Write Us on Anything You Want in Rubber.

Ask Goodyear

Goodyear efficiency experts will gladly co-operate with you in determining just what belt to use for any purpose. They will tell you the "why" of it. Remember that Goodyear quality dominates in this field as in tiredom. You assume no expense or obligation in asking questions.

W-S-M Electric Hoists for Heavy Duty



700 H.P. Electric Slope Hoist. Keystone Coal & Coke Co., Greensburg, Pa.

Strength and efficiency are the first considerations in designing W-S-M ELECTRIC HOISTS. Note the massive proportions of Bed Plates and Housings, Gears and Motor.

This Hoist handles a train of 50 loaded cars weighing 170 tons on a maximum grade of 6% for a maximum haul of 9000 feet. Duplicate of this hoist has since been installed at Canadian - Collieries (Dunsmuir), Ltd., Vancouver Island, B. C.

Send us details of your requirements.

The Wellman-Seaver-Morgan Company
Cleveland, Ohio, U. S. A.

New York, 50 Church Street
Denver, 611 Ideal Bldg.

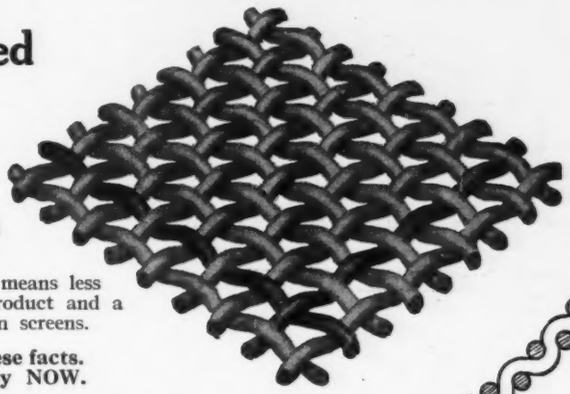
Little Screening Talks No. 3

Screen Durability

"The weaving of wire cloth is in itself largely mechanical but the selection of the material to be used in the manufacture of wire cloth for any special service is of vital importance and should be given the utmost care and consideration."

Length of life of screening depends on the *quality* of material used and the style of weave. Years of experience in the production of screening that lasts the "best that's made" guarantees good, long, honest service in any Ludlow-Saylor product.

Perfect Double Crimped Wire Cloth



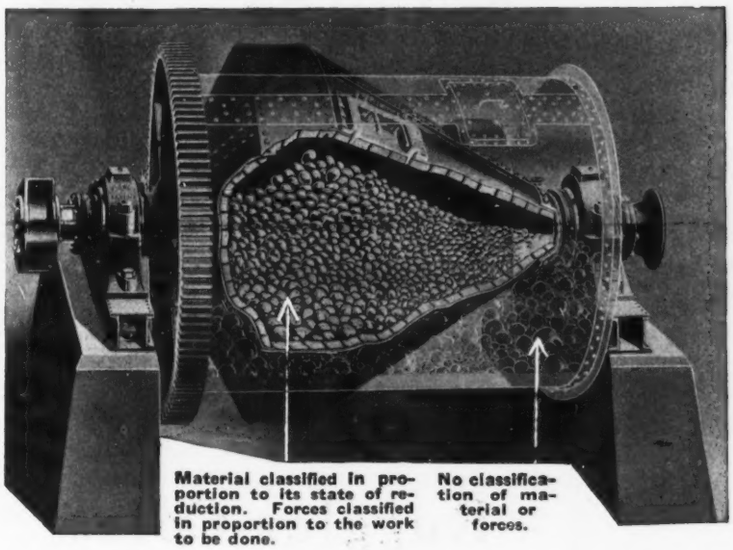
is woven so that the wires are uniformly crimped both in the warp and shoot giving the same height. This presents a uniform wearing surface to the action of the material screened and makes both wires perfectly stationary.

"Perfect" Screening on your crushers means less changing of screens, a more uniform product and a greater tonnage per dollar invested in screens.

Booklet "45" proves these facts. Better write for a copy NOW.

The Ludlow-Saylor Wire Co., St. Louis, Mo.

67% REPEAT ORDERS



Material classified in proportion to its state of reduction. Forces classified in proportion to the work to be done.

No classification of material or forces.

OUT OF THE TOTAL NUMBER OF

HARDINGE MILLS

IN OPERATION TODAY 67% WERE INSTALLED AFTER THEIR PURCHASERS HAD TRIED HARDINGE MILLS IN THEIR OWN PLANTS AND FOUND THAT THEY DO

ADJUST ENERGY TO WORK.

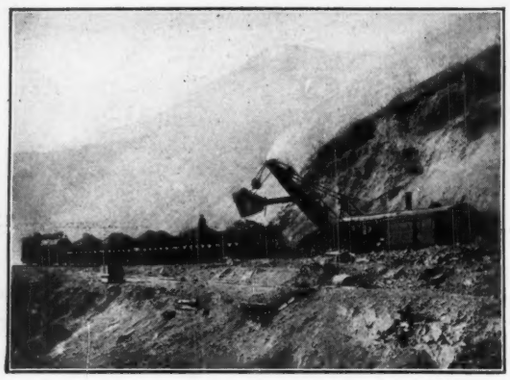
HARDINGE CONICAL MILL CO.

50 CHURCH ST., NEW YORK

London Office: Salisbury House

Cable Address: Hallharding, New York

Local Sales Agents: Mine & Smelter Supply Co., Salt Lake City, Utah
Hendrie & Bolthoff Mfg. & Supply Co., Denver, Colo.



It means a lower cost per ton of ore mined

We know what ore mining means and we have built that knowledge right into MARION Steam Shovels. Constant service, low operation and upkeep costs, big capacity, durable construction—all are a part of the standard equipment of

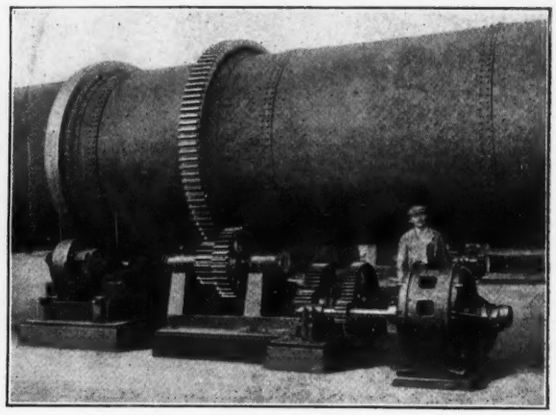
MARION
ESTABLISHED 1884
Steam Shovels

That's why they are being used where the work is hardest, where break-downs and delays mean an idle plant and great loss of money.

MARION Shovels are the product of 30 years' experience in the building of excavating machinery. Every part of our machinery is subjected to both chemical and physical tests and then the shovels themselves are put through a further rigid test under their own steam.

Why not write TODAY for Catalog 54 and full information?

The Marion Steam Shovel Co. Station D **Marion, Ohio**



Details of Ore Dryer

You Are Anxious to Save Money

You naturally employ the most efficient methods possible in the operation of your mine.

Have you started drying your ore before shipment? It is frequently less expensive to evaporate the water from ores than to pay freight charges for its transportation.

In drying of iron ore there is also a premium obtained from the higher iron content in the ore.

RUGGLES-COLES Ore Dryers

are now in use drying ores and concentrates and are in successful operation where dryers of less rugged construction have failed. They are also in use in locations where fuel is so expensive that no other dryer could be profitably used.

Write us for a list of users of Ruggles-Coles "Double Shell" Dryers.

Ruggles-Coles Engineering Co.

McCormick Bldg. CHICAGO **50 Church St. NEW YORK**

AMERICAN BRIDGE COMPANY
HUDSON TERMINAL-30 CHURCH STREET, NEW YORK

Manufacturers of Steel Structures of all classes particularly BRIDGES AND BUILDINGS

Steel Approach to Ore Dock No. 2 for Great Northern Railway Company, Superior, Wis.

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Atlanta, Ga. . . . . Candler Building
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Detroit, Mich., Beecher Ave. & M.C.R.R.
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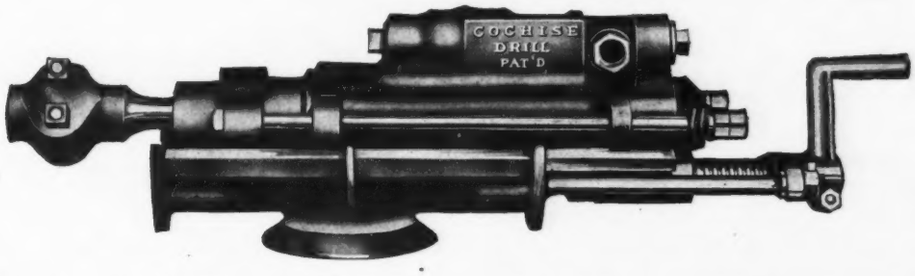
St. Louis, Mo., Third Nat'l Bank Bldg.
Denver, Colo., First Nat'l Bank Building
Salt Lake City, Utah, Walker Bank Bldg.
Duluth, Minn. . . . . Wolvin Building
Minneapolis, Minn., 7th Ave. &2nd St., S. E.

Pacific Coast Representative:
U. S. Steel Products Co. Pacific Coast Dept.
SAN FRANCISCO, CAL., Rialto Building
Portland, Ore. . . . . Selling Building
Seattle, Wash., 4th Ave. So. Cor. Conn. St.

Export Representative:
United States Steel Products Co., 30 Church St., N. Y.



The "Cochise" Is Strictly A One-Man Rock Drill

The high efficiency of Cochise Piston Rock Drills is not offset by high operating costs—it is light in comparison with other one-man machines and has a drilling capacity which exceeds all others of similar cylinder dimensions.

The air consumption is at least from 25 to 50% less per minute or per footage of hole drilled than the next best machine.

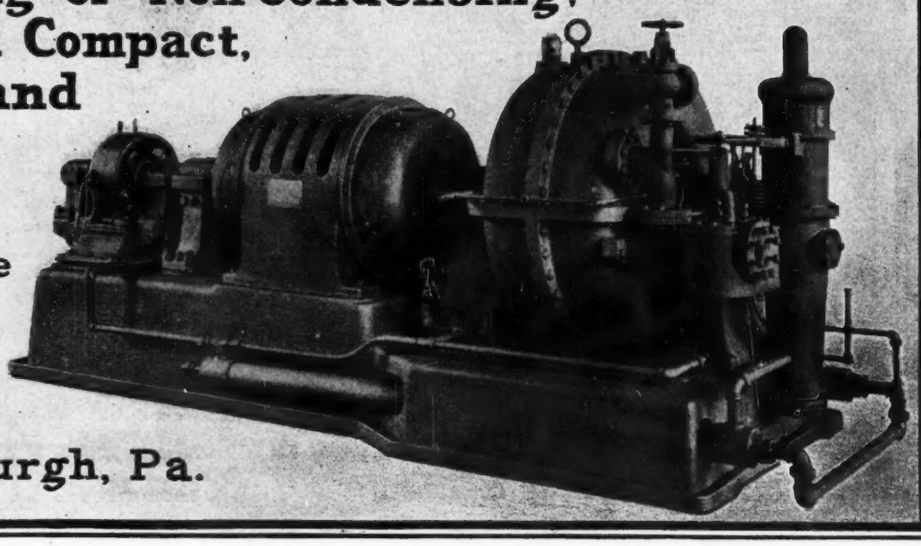
The Cochise is equally efficient in either drifting, sinking or raising.

Write for Descriptive Circular.

Cochise Machine Company, Los Angeles, Cal.

Small Turbines

For A.C. and D.C. Work, Condensing or Non-condensing; Light and Compact, Reliable and Efficient.

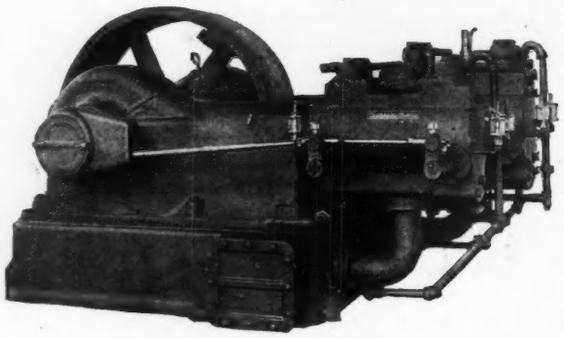


The Westinghouse Machine Co.

Prime Movers and Auxiliaries

East Pittsburgh, Pa.

Fairbanks-Morse Air Compressors



Two-stage Horizontal 14 x 9 x 10 Compressor equipped with copper tube intercooler and semi-rotative type mechanically operated suction valves.

Belted Type

Two-Stage Double Acting
Single-Cylinder Double Acting
Duplex Double Acting

In sizes for practically every mining requirement. Built with the ruggedness that characterizes Fairbanks-Morse machinery.

Oil Engines
Producer Gas Engines
Boilers
Air Compressors

Crushers and Rolls
Rock Drills
Drill Sharpeners

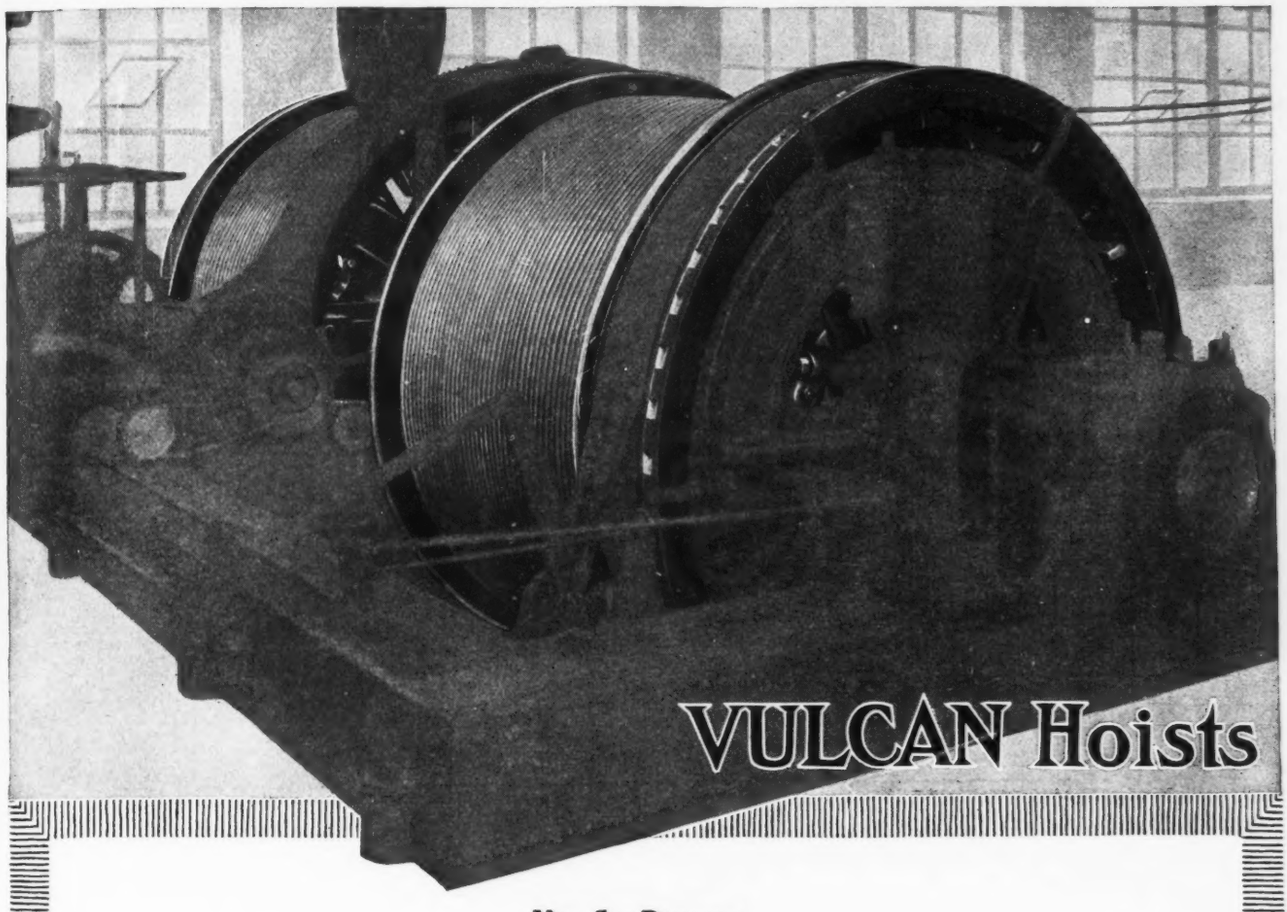
Steam and Power Pumps
Electric Motors
Electric Hoists

Oil Engine Hoists
Electric Pumps
Electric Light Plants

Fairbanks, Morse & Co.,

New York Chicago San Francisco St. Paul
St. Louis Denver Los Angeles Spokane
Omaha Salt Lake City Portland Seattle

(12 K 640)

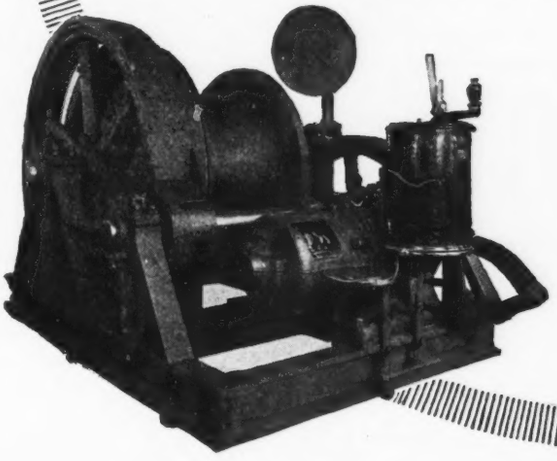


No. 5—Drums

Winning Features of

Vulcan Hoist Design

THE DIAMETER and width of Vulcan drums is calculated from rope diameter, number of feet to be wound and the loads and speeds that will be encountered. The heavy cast iron shells in Vulcan drums, with their end flanges, are fitted with stiff cast iron spiders. These distribute the winding strains along the shaft, and are accurately bored and key-seated if tight, and brass-bushed if driven through a friction clutch. The arms in the spiders have generous cross-section and are placed so as to equalize rope pressure on the shell. The spiders—cast separately—are joined by fitted bolts in reamed holes to the end flanges. A study of the illustration reveals the sturdiness of Vulcan drums and other hoist parts, that together make possible the uniformly high-grade and reliable service for which Vulcan Hoists are noted. *Let us assist you with your hoist problems.*



VULCAN IRON WORKS

1733 Main St., Wilkes-Barre, Pa.

New York—50 Church Street. Chicago—913 McCormick Bldg.

Classified Advertising

Positions Wanted, 3 cents a word, minimum charge 50 cents an insertion, payable in advance.
Positions Open, (Civil Service Examinations), Employment Agencies (Labor Bureaus), Business Opportunities, Wanted (Agents and Salesmen—Contract Work). For Sale, 5 cents a word, minimum charge, $1.00 an insertion.
Miscellaneous (Educational—Books) 10 cents a word, minimum charge $1.50 an insertion.
Count five words for keyed address care of New York; six for Chicago. Abbreviated words or symbols count as full words.

Copy should reach us not later than Saturday morning for ensuing week's issue. Answers addressed to our care, 505 Pearl St., New York or 1144 Monadnock Block, Chicago will be forwarded (except-ign circulars or similar literature).
No information given by us regarding keyed advertiser's name or address.
Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents. Send copies.
Advertisements calling for bids, $3.60 an inch per insertion.

POSITIONS WANTED

TECHNICAL MINING ENGINEER, eight years' practical experience, sample boy to manager; hard ores. P. W. 720, Engineering and Mining Journal.

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GRADUATE MINING ENGINEER, twenty seven years old, single, three years' practical experience, wishes change to position offering better future. Address Box 65, Alta, Utah.

ASSAYER, CHEMIST, ORE BUYER, last six years with mining company in Mexico, open for engagement anywhere; best references. P. W. 717, Engineering and Mining Journal.

SUPERINTENDENT desires position; 20 years' experience in gold mines; first class executive and practical millman; technical graduate. P. W. 638, Engineering and Mining Journal.

GRADUATE MINING ENGINEER, at present employed as general superintendent of large property, desires position as general manager or superintendent; highest references from present employers. P. W. 715, Engineering and Mining Journal.

PRACTICAL MILL SUPERINTENDENT, specialty, concentration and cyaniding gold ores; 15 years' experience with largest companies; skilled in ore testing, design, operation and handling dumps and tailings. P. W. 701, Engineering and Mining Journal.

ACCOUNTANT AND BOOKKEEPER, single, age 33, desires position; 13 years experience with mining companies; thorough knowledge of book keeping, payrolls, costs, typewriting, and all duties connected with mine office; excellent references. P. W. 711, Engineering and Mining Journal.

MINING ENGINEER AND GEOLOGIST, who has had a long experience in North and South America, is open for an engagement to do exploration and development work. P. W. 709, Engineering and Mining Journal.

GRADUATE CIVIL ENGINEER, 31, nine years' experience on miscellaneous construction work, including two years on copper blast furnaces and converters; salary, $2400. P. W. 712, Engineering and Mining Journal

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One Ingersoll-Rand Class "PE2" AIR COMPRESSOR
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Average Analysis—
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No Sulphur nor Phosphorous.
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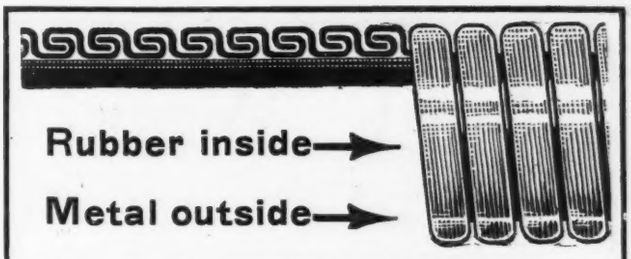

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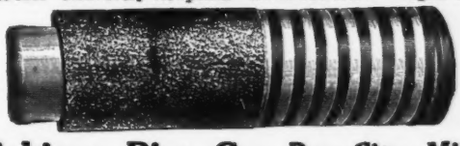

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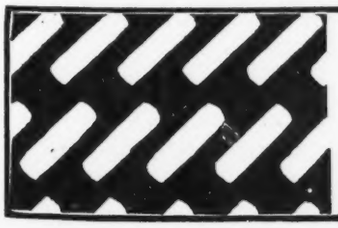

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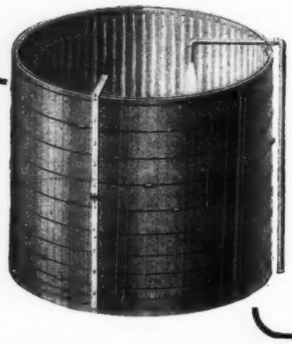
The wood pipe is our pipe made of durable specially selected California Redwood. It is replacing the steel pipe because the latter corroded and rusted and gave endless trouble. Our pipe, made of either Redwood or Douglas Fir, will **not** corrode, rust or scale, will be practically as permanent as cast-iron. Saturated Redwood or Douglas Fir are practically immune to decay. Our pipe has advantages over both cast iron and steel in ease of handling, less cost of transportation and low price. It has advantage over cast iron in elimination of breakage in transit and laying.



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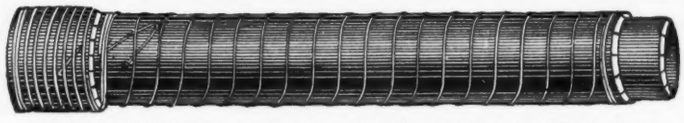
We have a large and most complete plant and are able to turn out all orders and contracts most promptly. *Write.*



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Water supplied through TAYLOR SPIRAL RIVETED PIPE

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Our first use of Spiral Riveted Pipe was in connection with our hydraulic mining operations as distributing lines from our main ditch system. The pipe was given severe service and proved entirely satisfactory. We are now using it in diameters up to 42 inches and heads up to 530 feet. We have found the pipe easy to lay and handle, strong for its weight and generally satisfactory.

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in every clime are REDWOOD tanks of sturdy worth.

In frigid Alaska and torrid Tropics our Redwood tanks are giving service under every condition and climate.

They stand out as the Acme of tank construction.

Economical, Efficient, Everlasting.

Redwood Tanks

are constructed of Clear, Air Dried Redwood from the great Redwood forests of California.

Easily worked, the soft, even grain of Redwood adapts itself admirably to tank construction.

Becoming readily saturated, the joints are perfect and the wood is protected from rot.

Fifty years is a short life for a Redwood tank.

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Decide on Redwood.

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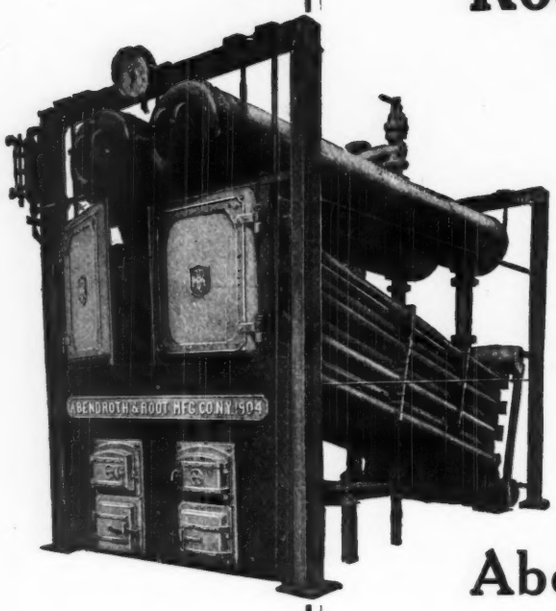
Root Water Tube Boilers Follow the Trail



Across the wilderness—out in the wilds—up and down forested slopes where even mules must pick their way, Root Water Tube Boilers follow the trail and arrive, in sections, ready and easy to set up.

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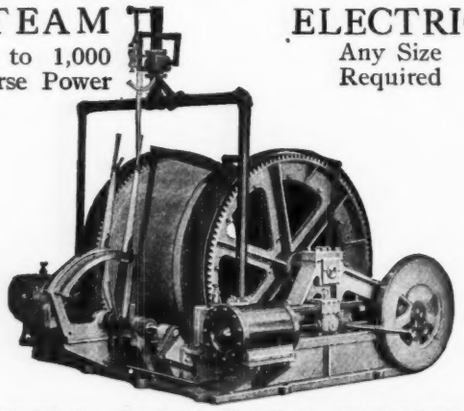
STEAM up to 1,000 Horse Power

ELECTRIC Any Size Required



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Built With Low Side Stands

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are used by mines and smelters to reduce handling costs.

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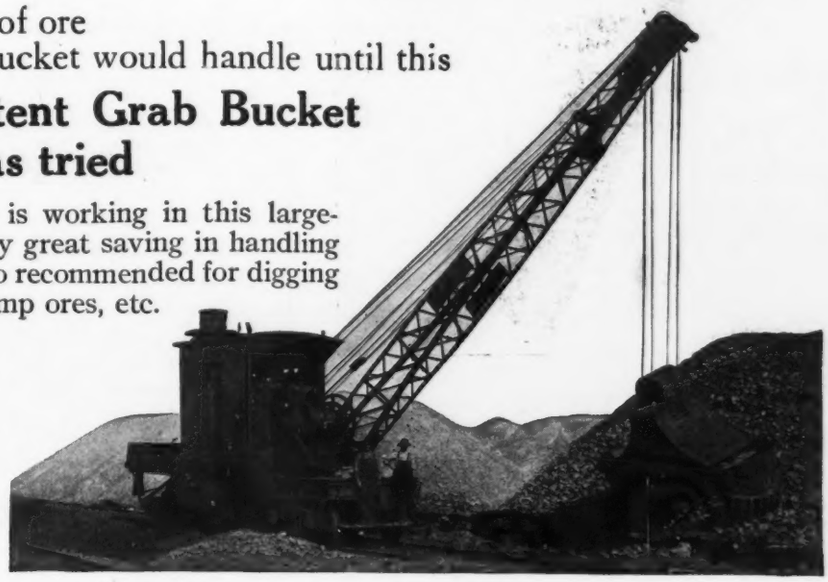
And today this bucket is working in this large-lump nickel ore at a very great saving in handling costs. The bucket is also recommended for digging in limestone, all large-lump ores, etc.

This bucket is being operated on a Brownhoist Locomotive Crane which is noted all over the world for its fine grab bucket operation.

We have spent 33 years studying the different ore handling problems. And our engineers will gladly help you solve your problems.



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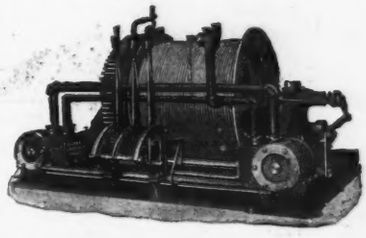

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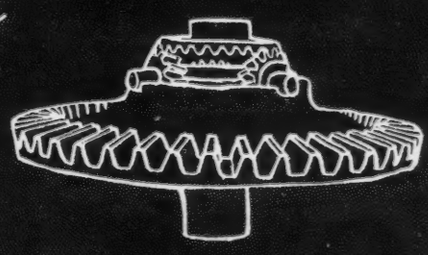

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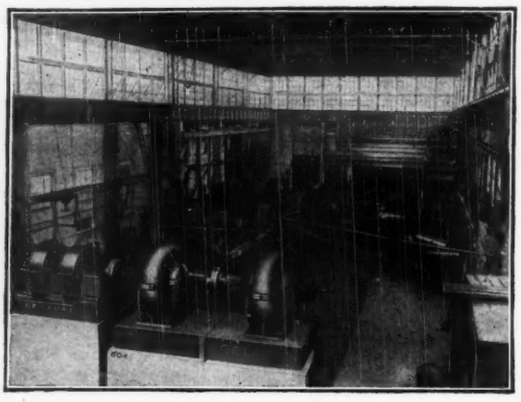

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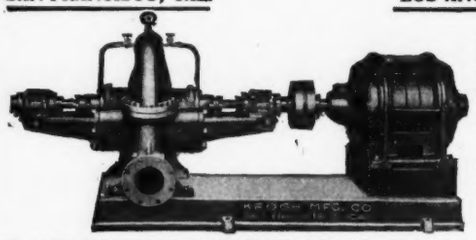

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Efficiency is the highest attainable.

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is practically designed by men who understand the problems of shaft sinking.

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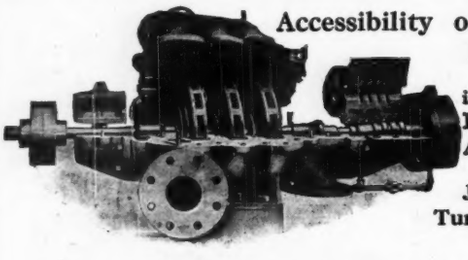

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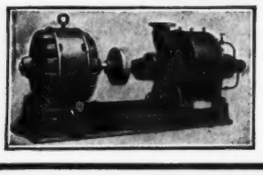

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FRENIER'S SPIRAL PUMP

The most durable pump for elevating
TAILINGS, SLIMES, BATTERY SANDS, etc.
No Valves **No Buckets**

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For Gritty Water and Hard Service

MEAN satisfaction to the mining man because they are the result of thorough knowledge and long experience in building special pumping machinery for mine service—particularly deep mine service.

It requires machinery of absolute reliability when emergencies arise in underground pumping stations, and PRESCOTT pumps are built specially for just such emergencies.

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115 Broadway, New York **Works: Milwaukee, Wis.**
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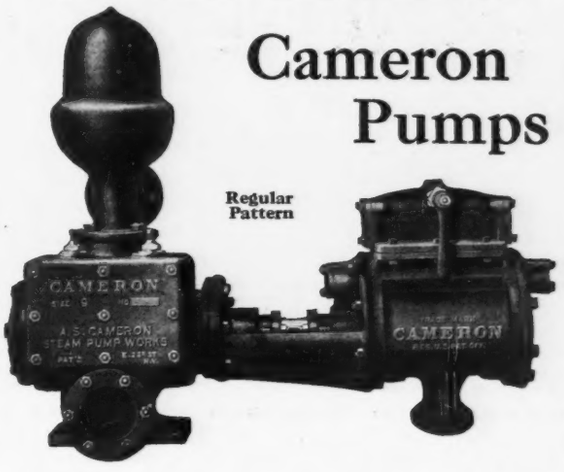
The Slogan of the Cameron—"Character: The Grandest Thing."

Cameron Pumps



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Maximum service at the lowest cost. That's what you want in a pump. Initial cost is incidental. In the Cameron Pump you get maximum service at minimum cost because of the Cameron Design. Different from other pumps. Fewer parts. Less wear. Longer service. Over 70,000 in use today all over the world.

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Samson Turbines at the Mine

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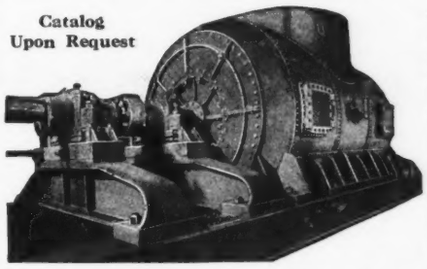

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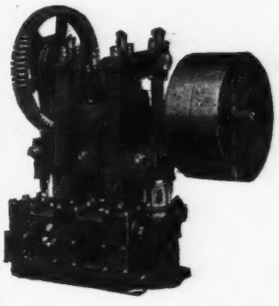

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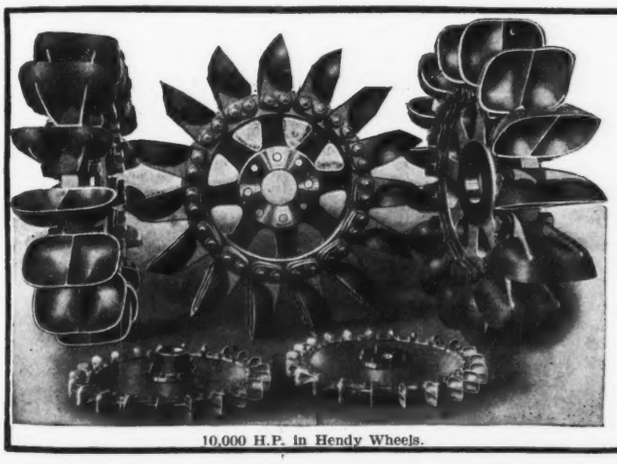

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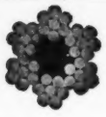

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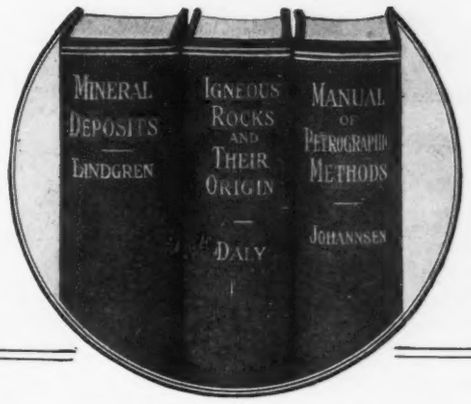

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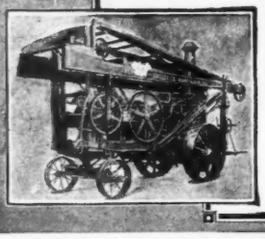

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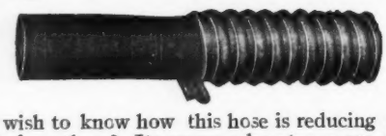

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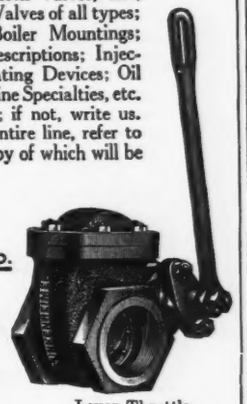
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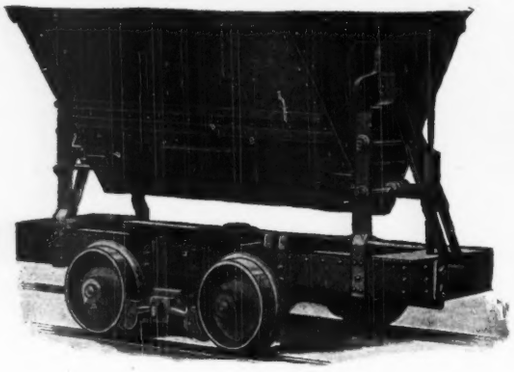

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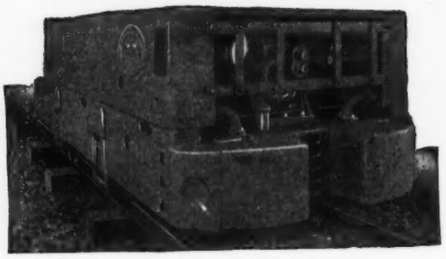

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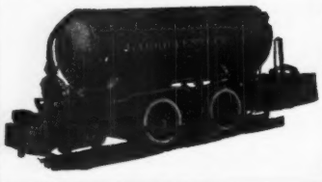

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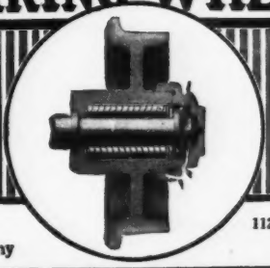

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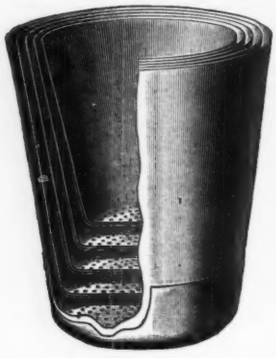

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Denver Engr. Wks. Co.
Dorr Cyanide Mchry. Co.

Alternators
Fairbanks, Morse & Co.

Amalgamators
Allis-Chalmers Mfg. Co.
Lane Mill & Mchry. Co.
Shareholders' Protective League, Inc.

Asbestos Supplies
Johns-Manville Co., H. W.

Assayers and Chemists
Ledoux & Co.
Sargent & Co., E. H.

Assayers' and Chemists' Supplies
Braun Corporation, The
Braun-Knecht-Heimann Co.
Buff & Buff Mfg. Co.
Denver Fire Clay Co.
Gurley, W. & L. E.
Heller & Brightly
Sturtevant Mill Co.

Axles
Standard Steel Wks. Co.

Balances and Weights
Ainsworth & Sons, Wm.
Braun Corporation, The
Braun-Knecht-Heimann Co.
Denver Fire Clay Co.
Electric Weighing Co.
Salt Lake Hardware Co.

Barges
American Bridge Co

Barometers
Ainsworth & Sons, Wm.

Bearings, Roller
Cyanide Plant Supply Co.
Hyatt Roller Bearing Co.
Sanford-Day Iron Co.

Belt Cement
Schieren Co., Chas. A.

Belt Dressing
Fairbanks, Morse & Co.
Schieren Co., Chas. A.

Belt Lacing
Fairbanks, Morse & Co.
Schieren Co., Chas. A.

Belting
Fairbanks, Morse & Co.
Goodrich Co., B. F.
Goodyear Tire & Rubber Co.
Robins Conveying Belt Co.
Schieren Co., Chas. A.

Blocks, Chain
Broderick & Bascom Rope Co.

Blowers
Abbé Engineering Co.
Allis-Chalmers Mfg. Co.
Connersville Blower Co.
Hendrie & Bolthoff Mfg. & Supply Co.
Monarch Engineering & Mfg. Co.
Westinghouse Mach. Co.

Boiler Graphite
Dixon Crucible Co., Jos.

Boiler Tubes
National Tube Co.

Boilers
Abendroth & Root Mfg. Co.
Fairbanks, Morse & Co.
Leffel & Co., James
Traylor Engr. & Mfg. Co.
Vulcan Iron Works.

Bone Ash
Braun Corporation, The
Braun-Knecht-Heimann Co.
Denver Fire Clay Co.

Books
Braun Corporation, The
Braun-Knecht-Heimann Co.
McGraw-Hill Book Co.

Bortz
Levine, Abr.

Brick, Fire
Denver Fire Clay Co.
Monarch Engineering & Mfg. Co.

Brick, Silica and Magnesia
Harbison-Walker Refractories Co.

Bridges
American Bridge Co.

Briquetting Machinery
American Grondal Co.
Braun Corporation, The
Braun-Knecht-Heimann Co.
Traylor Engr. & Mfg. Co.

Buckets
Allis-Chalmers Mfg. Co.
Broderick & Bascom Rope Co.
Brown Hoisting Machinery Co.
Hendrie & Bolthoff Mfg. & Supply Co.
Industrial Works
Marion Steam Shovel Co.
Stephens-Adamson Mfg. Co.
Watt Mining Car Wheel Co.
Wellman-Seaver-Morgan Co.

Bunkers and Hoppers
American Bridge Co

Burners, Oil
Braun Corporation, The
Braun-Knecht-Heimann Co.
Denver Fire Clay Co.
Monarch Engineering & Mfg. Co.

Cable Drilling
Broderick & Bascom Rope Co.
Leschen & Sons Rope Co., A.
Roebling's Sons Co., John A.

Cables
American Steel & Wire Co.
Broderick & Bascom Rope Co.
Goodrich Co., B. F.
Roebling's Sons Co., J. A.
Stromberg-Carlson Telephone Mfg. Co.

Cableways
Broderick & Bascom Rope Co.
Brown Hoisting Machinery Co.
Flory Mfg. Co., S.
Lidgerwood Mfg. Co.
Roeblings' Sons Co., John A.

Cages
Denver Engr. Works Co.
Wellman-Seaver-Morgan Co.

Carbide Lamps
Simmons Co., John
Wolf Safety Lamp Co. of America, Inc.

Carbon (Black Diamonds)
Atkins, Kroll & Co.
Byron & Hall
Levine, Abr.

Cars, Ore
Allis-Chalmers Mfg. Co.
American Bridge Co.
Atlas Car & Mfg. Co.
Fairbanks, Morse & Co.
Hendrie & Bolthoff Mfg. & Supply Co.
Hendy Iron Wks., Joshua
Sanford-Day Iron Co.
Stephens-Adamson Mfg. Co.
Watt Mining Car Wheel Co.
Wellman-Seaver-Morgan Co.

Castings
Abendroth & Root Mfg. Co.
Falk Co., The
Standard Steel Works Co.
Taylor-Wharton Iron & Steel Co.
Yuba Construction Co.

Cement, Iron
Johns-Manville Co., H. W.
Smooth-On Mfg. Co.

Cement Machinery
Power & Mining Machinery Co.
Sturtevant Mill Co.

Chain
Stephens-Adamson Mfg. Co.

Channeling Machines
Ingersoll-Rand Co.
Sullivan Machinery Co.

Chemicals
Braun Corporation, The
Braun-Knecht-Heimann Co.
Denver Fire Clay Co.
Matthiessen & Hegeler Zinc Co.
Roessler & Hasslacher Chemical Co.
Sargent & Co., E. H.
Solvay Process Co.

Chemists
See Assayers and Chemists

Chlorine
See Chemicals

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Cleveland Rock Drill Co.
Knox Mfg. Co.

Clarifiers
Sweetland Filter Press Co.

Classifiers
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Colorado Iron Works Co.
Deister Machine Co.
Denver Engr. Works Co.
Dorr Cyanide Mchry. Co.
Power & Mining Machinery Co.
Traylor Engr. & Mfg. Co.

Clutches, Friction
Fairbanks, Morse & Co.
Stephens-Adamson Mfg. Co.
Webster Mfg. Co.
Wellman-Seaver-Morgan Co.

Coal Cutters
Ingersoll-Rand Co.
McKiernan-Terry Drill Co.
Power & Mining Machinery Co.
Sullivan Machinery Co.
Whitcomb Co., Geo. D.

Coal-Handling Machinery
American Bridge Co.
Webster Mfg. Co.

Coal Punchers
Ingersoll-Rand Co.
Sullivan Machinery Co.
Whitcomb Co., Geo. D.

Coal Tipples and Coaling Stations
American Bridge Co.
Stephens-Adamson Mfg. Co.

Coal Washeries
Ingersoll-Rand Co.
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Compounds, Boiler
Johns-Manville Co., H. W.

Compressors, Air
Allis-Chalmers Mfg. Co.
Bury Compressor Co.
Fairbanks, Morse & Co.
Hendrie & Bolthoff Mfg. & Supply Co.
Ingersoll-Rand Co.
McKiernan-Terry Drill Co.
Monarch Engineering & Mfg. Co.
Nordberg Mfg. Co.
Norwalk Iron Works Co.
Sullivan Machinery Co.

Concentrators
Allis-Chalmers Mfg. Co.
Colorado Iron Works Co.
Deister Machine Co.
Denver Engr. Works Co.
Hendrie & Bolthoff Mfg. & Supply Co.
Hendy Iron Wks., Joshua
Power & Mining Machinery Co.
Traylor Engr. & Mfg. Co.

Concrete Mixers
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Power & Mining Machinery Co.
Smith Co., T. L.
Traylor Engr. & Mfg. Co.

Concrete Reinforcement
American Steel & Wire Co.

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Alberger Pump & Condenser Co.
Allis-Chalmers Mfg. Co.
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Prescott Steam Pump Co., F. M.
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Adbar Development Co.
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Hendrie & Bolthoff Mfg. & Supply Co.
Monarch Engineering & Mfg. Co.
Power & Mining Machinery Co.
Traylor Engr. & Mfg. Co.

Conveyors, Belt
Allis-Chalmers Mfg. Co.
Conveying Weigher Co.
Electric Weighing Co.
Goodrich Co., B. F.
Robins Conveying Belt Co.
Smith Co., T. L.
Stephens-Adamson Mfg. Co.
Webster Mfg. Co.

Conveyors' Chain
Electric Weighing Co.
Smith Co., T. L.
Webster Mfg. Co.

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Cranes, Locomotive
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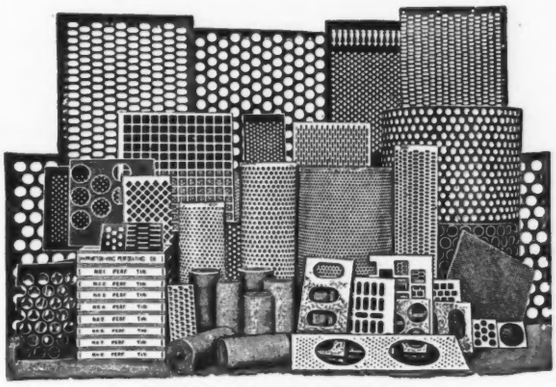

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Berger & Sons, C. L.
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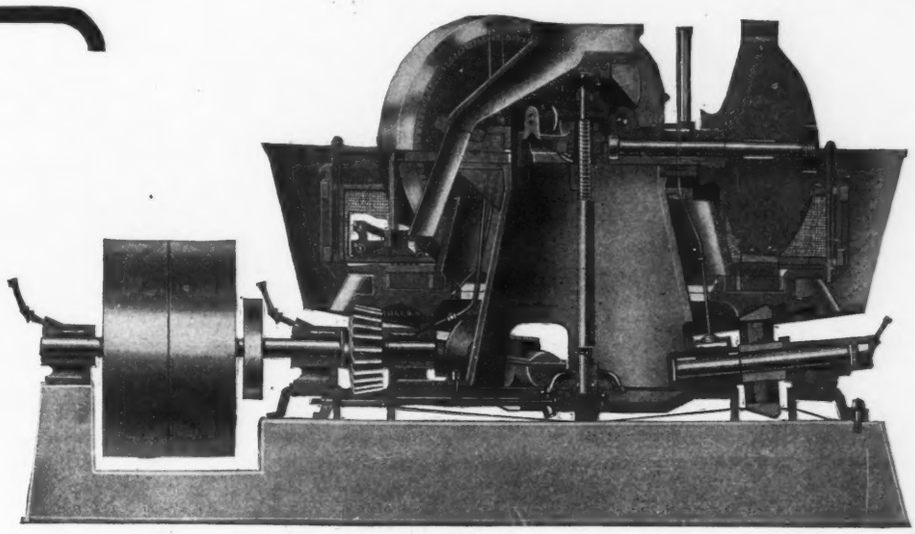

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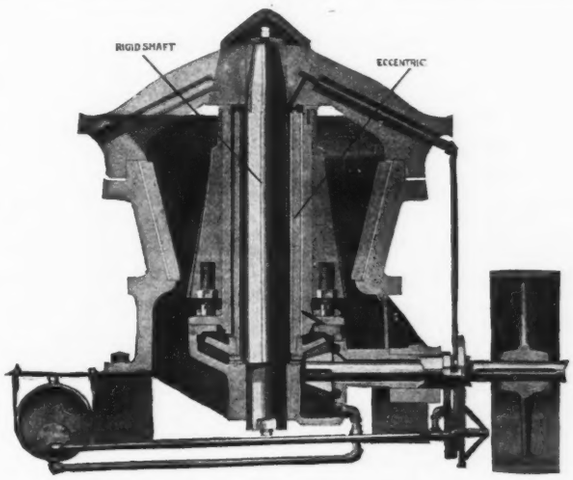

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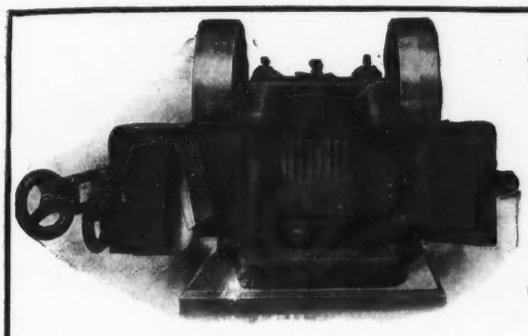

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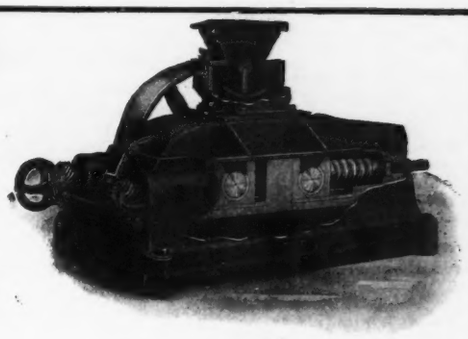

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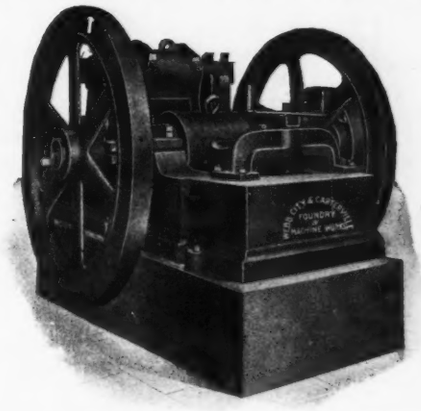

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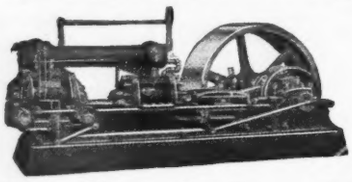
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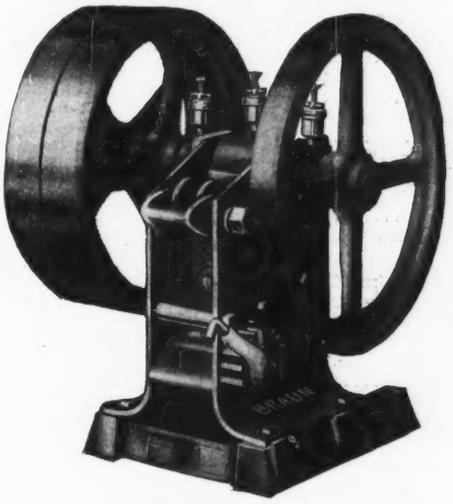

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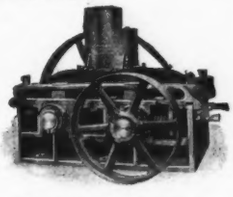

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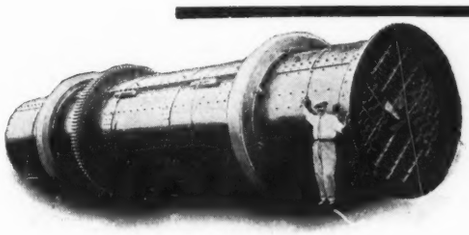

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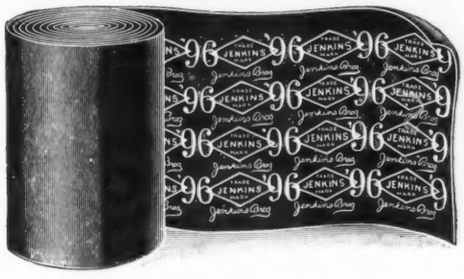

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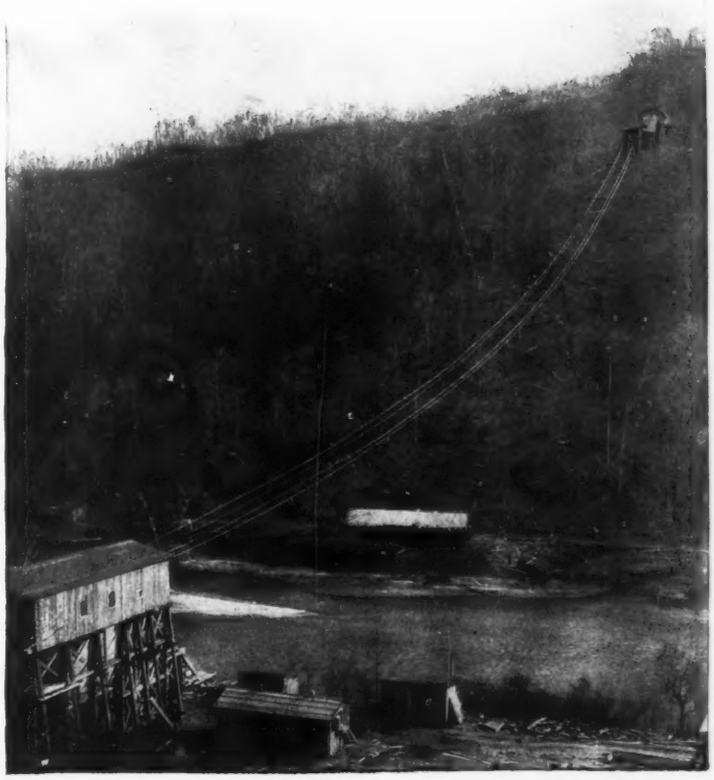

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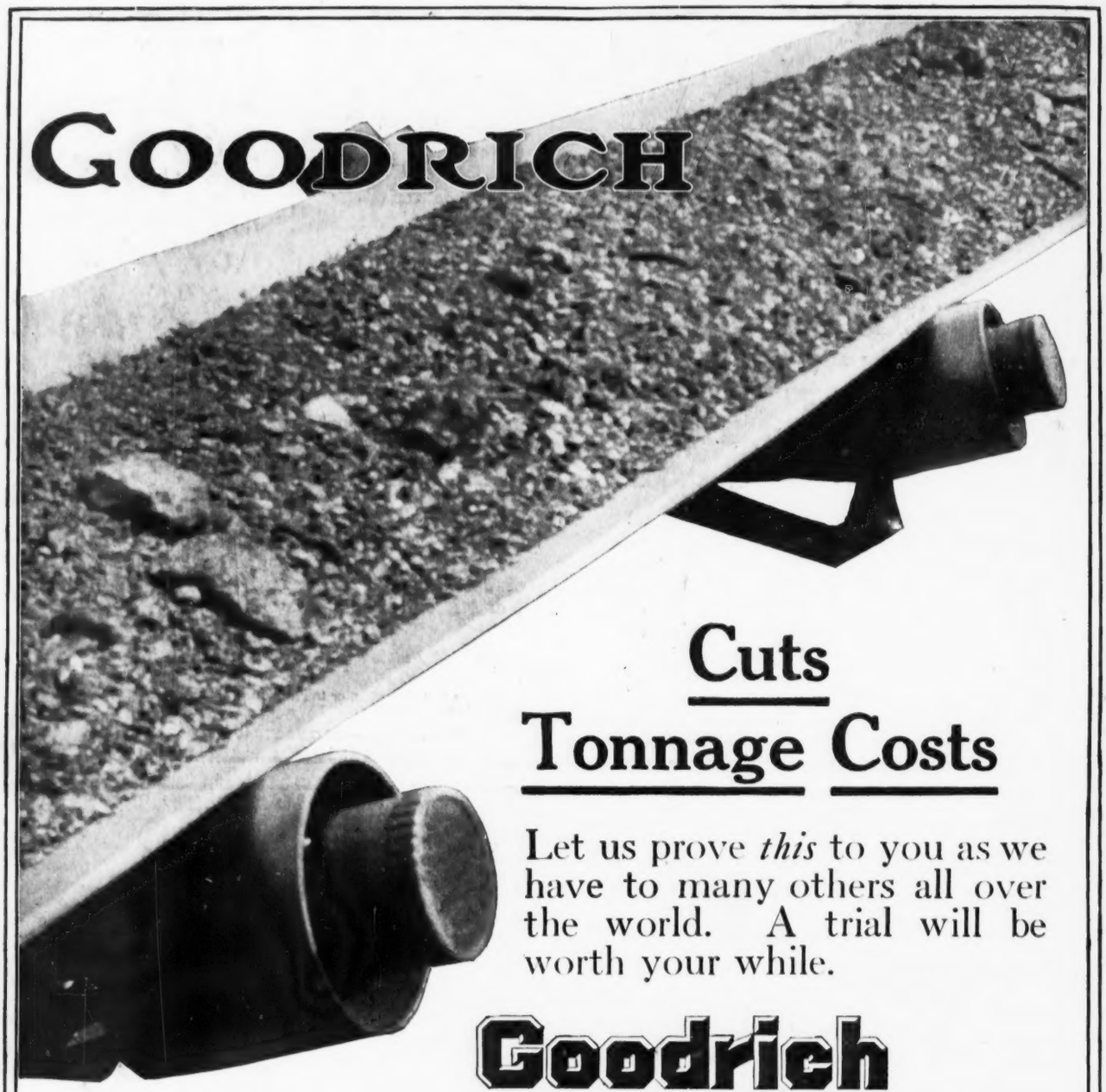

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